SHORT TERM ANALYSIS OF FUNCTIONAL RESULTS OF UNCEMENTED TOTAL HIP ARTHROPLASTY

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CERTIFICATE

*This is to certify that this dissertation entitled "***SHORT TERM ANALYSIS OF FUNCTIONAL RESULTS OF UNCEMENTED TOTAL HIP ARTHROPLASTY***" is the bonafide work done by* **Dr.M.KANNAN**, *under my direct guidance and supervision in the Department of Orthopaedic Surgery, Madras Medical College, Chennai-3 during his period of study from July 2003 - September 2006.*

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CONTENTS

Introduction

INTRODUCTION

Arthroplasty is an operation to restore pain- free motion to a joint and function to the muscles, ligaments and other soft tissue structures that control the joint.

The goals of total joint arthroplasty are to relieve pain, to provide motion while maintaining stability and to correct deformity.

Although total joint replacement is indicated in younger people, especially those with multiple joint involvement from a systemic disorder such as rheumatoid arthritis / lupus erythematosus, the procedure generally is reserved for older individuals and those with relatively sedentary lifestyle.

Pain in the hip joint is one of the most common causes in disabling human locomotion. Pain in the hip may be due to various causes like intra-articular fractures of hip or arthritic changes. There are many ways and methods by which the affected hip can be treated. This include analgesics, arthrodesis, excision arthroplasty, osteotomy and replacement arthroplasty.

Total Hip Arthroplasty is the most commonly performed adult reconstructive hip procedure. Implanting an artificial femoral head and acetabular socket to replace the degenerated / destroyed hip joint will relieve the pain and provides pain free, mobile and stable joint.

Total hip arthroplasty has been considered as one of the most revolutionary advances in the history of orthopaedics. The total hip arthroplasty may be cemented or uncemented. Historically the long term results of cemented total hip arthroplasty show loosening which continues to be a basic complication. Thus, there has emerged the concept of biological fixation rather than fixation with methylmetha crylate. The overall results of press fitting alone were not good enough to consider as a sole method of fixation. With the advent of porous coated implants, which allow bone to penetrate the surface of the prostheis and secure it, thus provide complete fixation and better results.

Since it has been proved that the primary surgery stands the best chance of long term success, it should be done with utmost technical precision. Proper patient selection, implant selection and implantation are very essential for the successful outcome of the surgery.

We have decided to study the short-term followup of functional results of porous coated uncemented total hip arthroplasty prospectively, done in our institution during last 3 years.

Aim of the Study

AIM OF THE STUDY

The aim of this study is to analyse the short-term followup of functional results of 31 porous-coated uncemented total hip replacement surgeries prospectively, done in our institution during the period September 2003 to February 2006.

Review of Literature

HISTORICAL REVIEW

Arthroplasty in the broadest sense is a reconstructive procedure that alters the structure or function of a joint. Although major surgical procedures occasionally were performed in early 1800s, it was not until the introduction of general anaesthesia and aseptic techniques during the later half of the 19th century.

Resection arthroplasty of the hip was first reported in Europe in the early 1800s. This procedure was performed primarily for the treatment of patients with chronic bacterial and tuberculous arthritis and the early results were poor.

Between 1921 and 1945, G.R. Girdlestone refined the indications and technique for resection arthroplasty. This procedure eventually came to be known as Girdlestone psuedoarthrosis.

In 1902, Murphy began to use muscle and fascia as the interposing materials between the articulating surfaces. Interposition arthroplasties were also reported in the 1920s by Campbell and MacAusland who preferred to use fascia lata as the interposition material. The results were considered to be reasonably good.

The cup arthroplasty is an unique type of interposition arthroplasty, introduced by Smith-Peterson of Boston. He initially used a cup made of glass as an interposition arthroplasty. The glass cups were too brittle and they frequently fractured. Thereafter he began using vitallium cups.

In 1953, Haboush reported double cup or surface replacement arthroplasty, in which two metallic cups were fixed with acrylic cement, one onto femoral head and one into the acetabulum.

In 1977, Townley began to use polyethylene acetabular components. Although there was an early enthusiasm, an unacceptable number of failures became evident in the first 5 years following this surface replacement arthroplasty.

The Austin-Moore's prosthesis and Thompson's prosthesis provided primising results in early follow-ups. However the problem of erosion of acetabular surface with recurrence of pain in the hip became inevitable.

Sir John Charnley began the development of various types of total hip replacement arthroplasties between 1958-1963. His development of Low Friction arthroplasty (LFA) led to dramatic improvements in the function and durability of total hip replacement and he is credited as being the "father of total hip replacement".

Charnley's development of LFA and the introduction of self-curing acrylic cement represent the most significant developments in orthopaedic surgery. He divided his work in total hip arthroplasty into six phases of development.

Phase 1: Basic research into the lubrication of normal animal joints.

Phase 2: The use of polytetrafluroethylene, TEFLON

Phase 3: Low Friction Arthroplasty as a principle.

Phase 4: Bonding of implant to living bone by quick setting acrylic cement

Phase 5: High-Density polyethylene

Phase 6: Control of infection and thromboembolism

Charnley's work was followed by Muller with his own modification of prosthesis design of cemented total hip prosthesis.

Credit for the uncemented metal prosthesis, introduced in 1960, generally is given to Ring of England. The initial Ring prosthesis consisted of a metallic acetabular component screwed into the pelvis. In the late 1960s, Tronzo modified it by replacing acetabular screws with one large and 3 smaller prongs which were driven into the acetabulam, thus preventing rotation.

The methods of cementless fixation of implants are press-fit fixation, macro-interlock fixation (such as steps, ribs, threads, dimples or flutes) and bone ingrowth.

The porous-coated implants recently used initially depend upon a press-fit and bone ingrowth occurs over a period of time.

The system of cementless fixation has come into vogue for younger patients in whom revision surgery may be necessary at a later date.

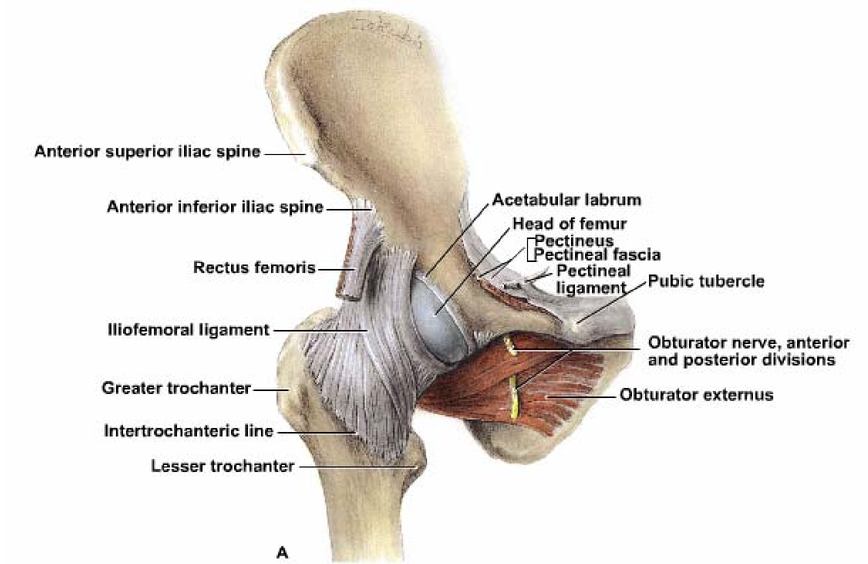
ANATOMY

The hip joint is a classical ball and socket joint created by the articulation of the head of the femur with the concave socket of the acetabulum. The acetabulum is created by the confluence of the ilium, the ischium, and the pubis. The articular surface of the acetabulum presents a horseshoe-like surface with a central, inferiorly directed notch that contains the pulvinar, a fat cushion covered with synovium. The articular cartilage of both the femur and the acetabular surfaces is thicker peripherally and thinner centrally. The opposing surfaces are regularly and reciprocally curved, but at any given time only two fifths of the femoral head occupies the acetabulum.

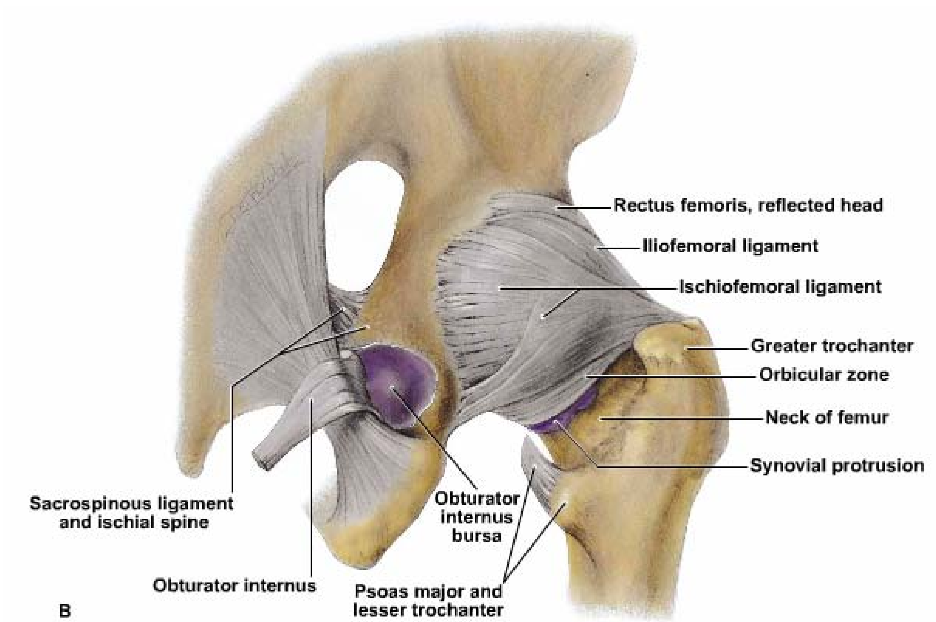
The hip joint is a diarthrodial synovial joint with synovial membrane lining the anterior neck of the femur to the intertrochanteric line but only the medial half of the posterior neck. The joint is covered by a capsule, made up of outer longitudinal and inner circular fibres, anteriorly the thick iliofemoral ligament of Bigelow, posteriorly the thinner ischiofemoral ligament, and inferiorly the pubofemoral condensation.

Characteristic vascular patterns feed the hip. Rich subsynovial anastomoses occur at the margins of the articular cartilage. Pericapsular vessels are seen at the attachment of the capsule at the acetabulum and enclose anastomoses from the femoral circumflex artery, acetabular

HIP JOINT - ANATOMY



ANTERIOR ASPECT



POSTERIOR ASPECT

branches of the obturator artery, and articular branches of the superior gluteal artery.

MUSCLES PRODUCING THE MOVEMENTS

Flexion

Psoas major and iliacus assisted by pectineus, rectus femoris and sartorius.

Extension

Gluteus maximus and hamstring muscles.

Adduction

Adductors longus, brevis and magnus assisted by pectineus and gracilis.

Abduction

Glutei medius and minimus assisted by tensor fasciae latae and sartorius.

Medial Rotation

Tensor faciae latae and anterior fibers of glutei medius and minimus.

Lateral Rotation

Obturator muscles, gamelli and quadratus femoris assisted by piriformis, gluteus maximus and sartorius.

BIOMECHANICS

Biomechanics Of The Normal And Replacement Hip Joint

Bone is living and changes its shape and structural properties according to how it is loaded. The implant material react biologically with the body in a way that can cause considerable damage if care in their selection is not taken.

It is necessary to determine, by experiment or calculation, the forces acting on the normal hip structure - due primarily to the external loads and the muscle forces acting at the hip joint. Knowing the forces, the stresses can be calculated and this information used in the design process to try to ensure that the replacement joint components can withstand the stresses without failing.

There are two ways of estimating these stresses. The more traditional method is to measure them, usually by fixing strain gauges at important locations on the bone, which is then loaded. The stress is calculated from the strain, knowing Young's modulus for the strain gauge material.

Experimental work has, on the whole, been replaced by computational methods using Finite Element Analysis. This technique involves creating two dimensional or three dimensional models of the structure made up of small elements applying joint and muscle loads to the model and letting the computer calculates the stresses.

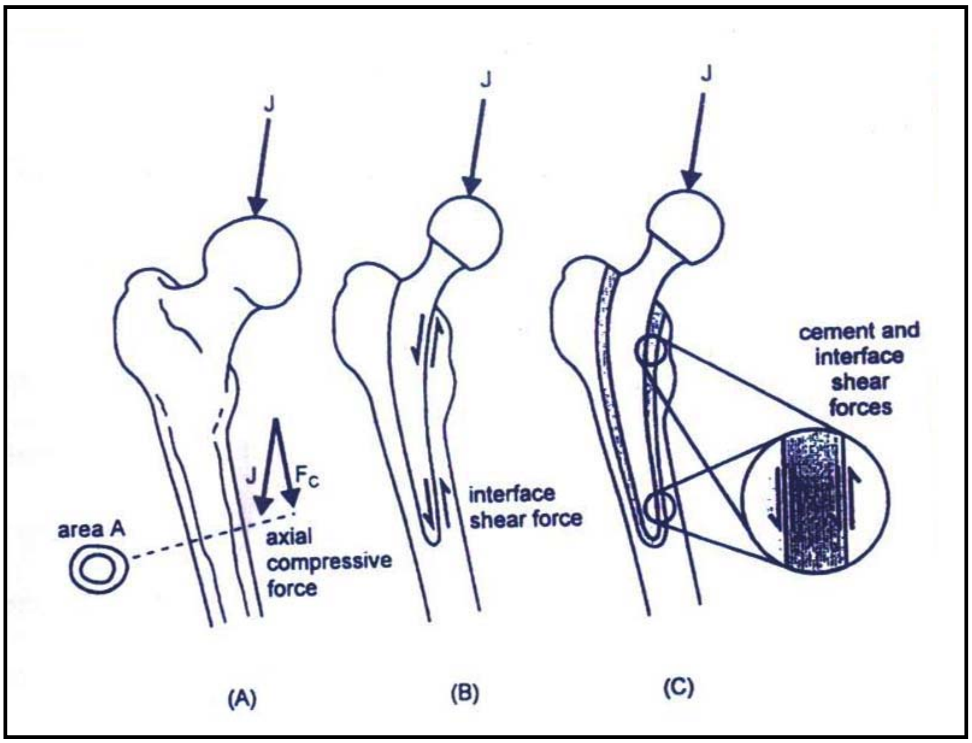
The load transfer mechanisms in normal and replacement hips are quite different. The stresses generated in both structures will be discussed for axial, bending and torsional loads in the femur and femoral stem and for compressive loads in the acetabulum. In practice, all methods of calculating stresses are only estimate because the material properties of bone and the bone - implant interface properties are variable and cannot be determined accurately.

FORCES ACTING ON THE HIP

The body weight can be depicted as a load applied to a lever arm extending from the body's center of gravity to the center of the femoral head.

The abductor musculature, acting on a lever arm extending from the lateral aspect of the greater trochanter to the center of the femoral head, must exert an equal moment to hold the pelvis level when in a one-legged stance, and a greater moment to tilt the pelvis to the same side when walking or running. Since the ratio of the length of the lever arm of the body weight to that of the abductor musculature is about 2.5:1.

When lifting, running, or jumping, the load may be equivalent to 10 times the body weight. Therefore excess body weight and increased



SHEAR FORCES AT BONE-STEM AND BONE-CEMENT-STEM INTERFACE

physical activity add significantly to the forces that act to loosen, bend, or break the stem of a femoral component.

The forces on the joint act not only in the coronal plane, but because the body’s center of gravity (in the midline anterior to the second sacral vertebral body) is posterior to the axis of the joint, they also act in the sagittal plane to bend the stem posteriorly.

Such forces cause posterior deflection or retroversion of the femoral component.

Rotational stability of the stem can be increased both proximally and distally. Increasing the width of the proximal portion of the stem to better fill the metaphysis increases the torsional stability of the femoral component.

Modifications of the distal portion of the stem may add to rotational stability as well. Longitudinal cutting flutes and extensive porous coatings that “scratch” the diaphyseal endosteum improve rotational stability in the absence of cement.

COMPRESSIVE STRESSES IN THE FEMUR

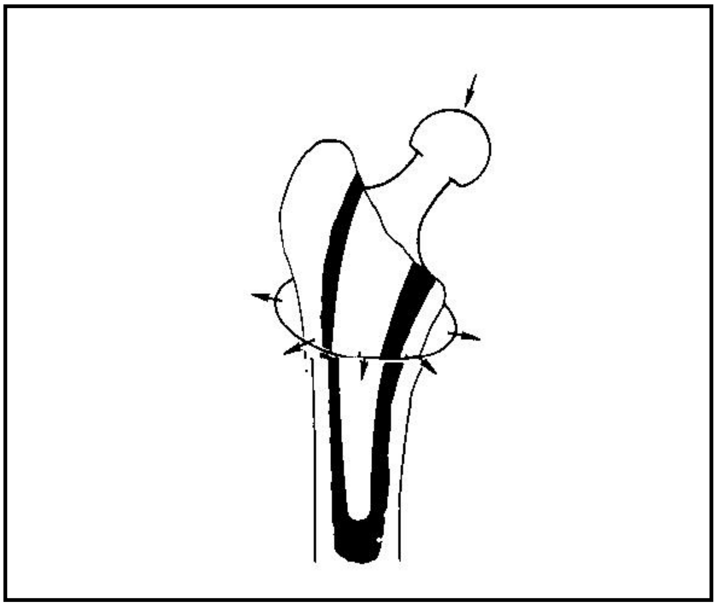
The highest moments occur in the coronal plane. However, there are also moments acting in the sagittal and transverse planes. The compressive joint force is transferred from the stem to the femur as a shear force, passing directly from the stem to the bone in a cementless prosthesis, or via the cement layer in cemented prosthesis, causing shear stresses in the cement. If the stem-bone bond or stem-cement-bone bond is not sufficiently strong, the prosthesis will loosen and sink down the medullary cavity. The compressive stresses in the stem itself can be found by dividing the compressive load taken by the stem at any section along its length by the area of that cross section.

BENDING STRESSES IN THE FEMUR

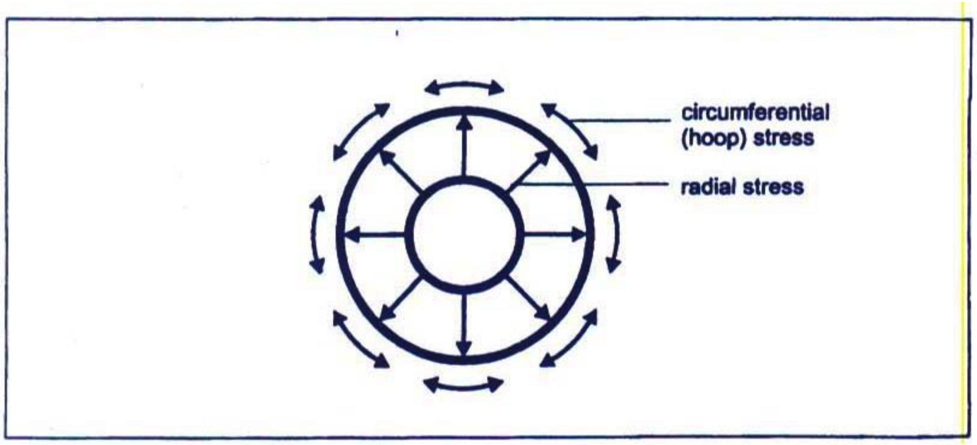
The joint force acting on the normal hip produces not only a compressive stress but also a bending stress in the femur. The bending stress is caused because the direction of the joint force vector is not along the neutral axis so the femur provides one main contact point and the lateral distal side provides another, which counteracts the tendency for the stem to rotate due to the bending action of the joint force. The main likelihood of stem failure is if it loosens proximally in which cases the bending moment at the distal end increase drastically and failure can occur.

HOOP STRESSES DUE TO BENDING

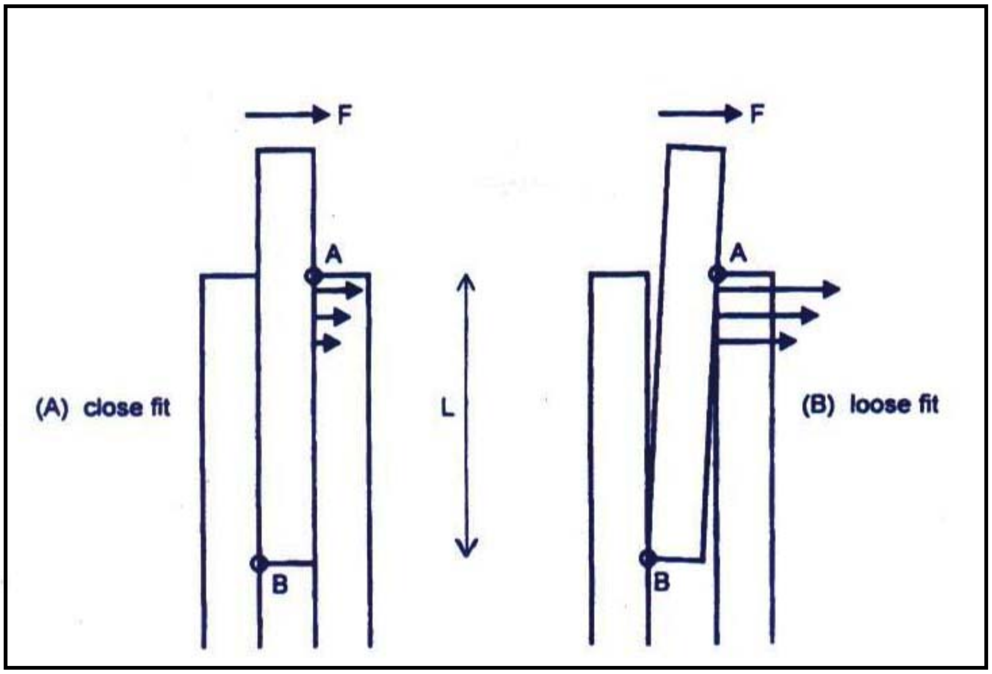
Radial and circumferential (hoop) stresses are also generated under the action of a bending load. Radial stresses (stresses that are directed radially outward from a central point) are greatest at the points of bone - stem contact at the proximal and distal ends and are less in between.



HOOP STRESSES



DIRECTION OF RADIAL AND TENSILE HOOP STRESSESS IN A HOLLOW CIRCULAR STRUCTURE



HIGH STRESS CONCENTRATIONS
DUE TO A LOOSE - FITTING STEM

These radial stresses in turn cause hoop stresses in the bone which are primarily tensile stresses that act in a direction that tends to split the bone.

In Figure which represents a cementless prosthesis, points A and B have the highest radial stress. These stresses cause tensile hoop stresses around the circumference. In Figure the stem has a loose fit in the bone giving rise to very high local stresses A and B, causing hoop stresses that are high enough to fracture the bone. It has been shown that the radial stresses are inversely proportional to the square of the length of contact, L of the stem with the bone. This means that stems of short length are prone to cause high radial stresses on the bone.

STRESSES IN THE ACETABULUM

The acetabulum is subjected to a compressive load, the joint force, which manifests as a compressive stress. The normal acetabulum has a slightly larger diameter than the head of the femur, which has an approximately spherical surface. From a structural point of view, it can be considered to be a sandwich of cancellous bone between two layers of cortical bone - one covered with articular cartilage forming the joint bearing surface. This structural sandwich forms a lightweight structure with good rigidity under a bending load. Under the compressive joint loading caused by the femoral head pressing into the acetabulum, the cortical shells are highly stressed and broken, which means that the cancellous bone, which is normally not highly stressed, has to take the load passed to it from the prosthesis cup. The replacement femoral head and cup usually have a smaller diameter than the natural components which means that there tend to be higher stress concentrations in the regions of contact because the contact area is smaller.

When cementless acetabular fixation is used, metal backing is required for skeletal fixation. Ideally the metal should contact acetabular subchondral bone over a wide area to prevent stress concentration and to maximize the surface area available for bone ingrowth. The accuracy of acetabulum preparation and the shape and size of the implant relative to the prepared cavity dramatically affect this initial area of contact and the transfer of stress from implant to the pelvis. If a hemispherical component is strictly undersized relative to the acetabulam then stress will be transferred centrally over the pole of the component with the potential for equatorial gaps between the implant and bone. Conversely if the component is slightly larger than the prepared cavity stress transfer will occur peripherally with the potential for fracture of the acetabular rim during implantation. Polar gaps also may remain from incomplete seating of the component. In a cadaver study, Kin *et al.*, found that an acetabular component with a rim diameter slightly larger than the dome diameter providing the best compromise between polar and equatorial contact. Current research has focused on the initial stabilizing and contact areas of cementless acetabular components. The manner in which stress is transferred to the pelvis and the patterns of bone remodeling after bone ingrowth has occurred still are not completely understood.

LOAD TRANSFER IN CEMENTLESS STEMS

Cementless stems with no surface coating rely on a good press fit in the bone. If the fit is not good, the stem will subside. The press fit promotes hoop stresses in the bone which reduces stress shielding. Early stems were smooth but were not successful because the bone shape did not match the stem shape well enough, so many subsided or loosened.

Cementless stems are now surface coated usually with hydroxyapatite. Some are coated all over which helps bone ingrowth and potentially eliminates metal debris. It also gives the opportunity for the bone to contact a larger area of the stem which lessens the chance of failure of the bond under subsequent loading. However, fully coated stems promote stress shielding of the bone. The optimal amount of coating is not really known.

Lack of distal contact in cementless stems is known to be a cause of thigh pain. Custom made plastic sleeves are therefore sometime used to provide good distal contact to reduce thigh pain. It is generally agreed now that distal anchoring of the stem does not affect proximal stress shielding.

THE EFFECT OF FEMORAL SHAPE ON LOAD TRANSFER

All stems are tapered to prevent subsidence and many, especially the cementless ones, have a proximal wedge so that the stem can rest on the bone, allowing transmission of compressive forces as well as shear forces.

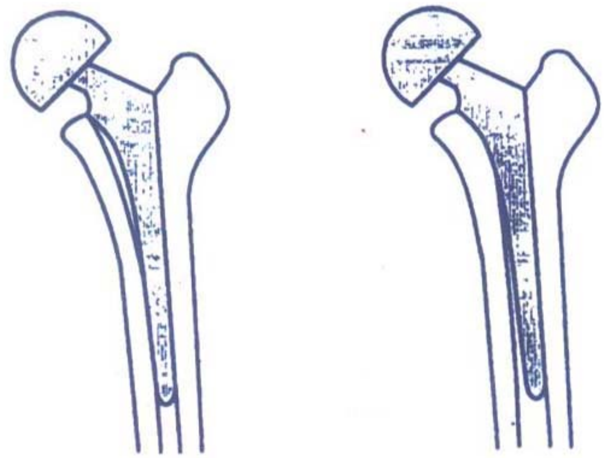
The shape of the stem is very important in cementless femoral implants because the stem needs to contact a large proportion of the femur. If its outer dimensions at any point along its length are smaller than the corresponding inner dimensions of the meduallry canal, there will be gap that can happen. In Figure A, the stem has a greater curve than that of the femur so has poor medial contact with it. In Figure B the stem fits proximally but not distally because its taper is too greater for the bone. Careful stem selection overcomes most potential shape problems, but the range of shapes and sizes offered in a commercial hip system may not always be adequate to cover a wide range of femurs.

JOINT WEAR

Wear can be defined as the loss of material from the surfaces of the prosthesis as a result of motion between those surfaces. Material is lost in the form of particulate debris.

There are three main types of wear that occur between bearing surfaces.

- Adhesive wear



EXAMPLES OF MISMATCHING OF THE STEM TO THE FEMORAL CANAL

- Abrasive wear

- Fatigue wear

The factors that determine wear are (1) the coefficient of friction of the materials and their surface finish (2) the hardness of the materials (3) the applied load (4) the sliding distance for each cycle and (5) the number of cycles that occur over time.

Adhesive wear

Adhesive wear occurs because the two bearing surfaces stick to each other when they are pressed together and one, usually the softer one, is torn off by the harder one. Bearing surfaces should, therefore, be made up of materials that have a low level of adhesion. Lubricants provide a layer between the two materials which reduces wear.

Abrasive wear

Abrasive wear occurs because surfaces are not perfectly smooth. Bearing surface that need to endure heavy loads under many cycles of loading, such as hip joint replacements, must have highly polished surfaces with a typical surface roughness of 0.3 microns so as to minimize abrasive wear. Good circulation of lubricant is important so that wear particles can be removed and not rub against the bearing surfaces causing even more wear.

Fatigue wear

Repetitive loading produces subsurface cracks and particles, or sheets of material subsequently delaminate and are lost from the surface. In total hip arthroplasties, abrasive and adhesive mechanisms are the most important. With the highly confirming surfaces in total hips, fatigue wear appears far less important than in total knee arthroplasties.

IMPLANT DESIGN

Nonporous Cementless Femoral Components

Analysis of porous femoral components revised for reasons other than loosening has established that amount of porous surface actually occupied by bone generally is less than 10%. This fact has led some investigators of question whether bone ingrowth is in fact necessary for implant fixation. With concerns about fatigue strength of porous implants, ion release, and adverse femoral remodeling, some cementless femoral components have been fabricated without porous coating. These devices may have grooves and other surface modification that provide a macrointerlock with bone.

Current porous stem designs differ in their materials, shape, location of porous surface and stiffness. Experience has been confined largely to the use of two materials:

(1) Titanium alloy with a porous surface of commercially pure titanium fiber - mesh or beads and (2) cobalt - chromium alloy with a sintered beaded surface. Titanium has been recommended by many designers because of its superior biocompatibility, high fatigue strength and lower modulus of elasticity.

Cementless total hip stems are of two basic shapes:

• Anatomical

• Straight

Anatomical

Anatomical femoral components incorporate a posterior bow in the metaphyseal portion and an anterior bow in the diaphyseal portion, corresponding to the geometry of the femoral canal. Right and left stems are therefore required, and anteversion must be built into the neck segment. Anatomical variability in the curvature of the femur usually requires some degree of over reaming of the canal.

Straight

Straight stems have a symmetrical cross section and fit either side. The cross - sectional dimensions of straight stems are variable, with some being highly canal filling and proximally tapered and others parallel - sided with a lesser degree of proximal canal fit. The aim of both types is to provide optimal fit both proximally and distally and thereby achieve axial and rotational stability by virtue of their shape.

HEAD AND NECK DIAMETER

If a prosthesis with a small femoral head is used, the diameter of the neck must more closely approach that of the head to make the neck strong enough, and the neck tend to impinge on the edge of the cup during a shorter arc of motion. The socket’s depth and beveled edges and the greater diameter of the head in comparison to the neck in total hip systems with larger heads are features that allow a greater range of motion. Furthermore, the arcs of flexion, abduction, and extension are increased by making the neck oval or trapezoidal. The neck diameter of a modular femoral component is larger than that of the conventional component if the head component has an attached neck extension or “skirt”. Clinically, the addition of a skirt to the femoral head can reduce the total flexion-extension range of motion by 15-20 degrees and internal rotation by 10 - 15 degrees. In addition, there is less margin for error in positioning of the femoral and acetabular components when prosthetic range of motion is reduced. Increased polyethylene wear at the rim of the socket, subclinical subluxation, and more frequent dislocation may be the consequences of heads with neck extensions.

NECK LENGTH AND OFFSETS

The ideal femoral reconstruction reproduces the normal center of rotation of the femoral head. This location is determined by three factors: (1) vertical height (vertical offset), (2) medial offset (horizontal offset or, simply, offset), and (3) version of the femoral neck (anterior offset).

(1) Vertical Offset

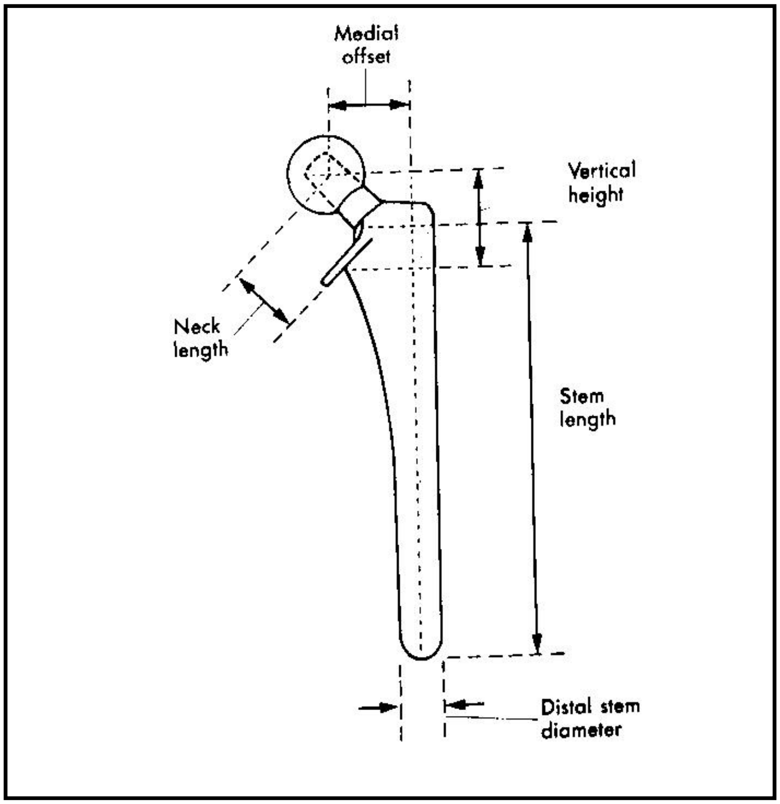
The vertical height of the femoral head usually is measured as the distance to the center of the head from a fixed point, such as the lesser trochanter. Restoring this distance is essential to correct leg length. Using a stem with variable neck length provides a simple means of adjusting this distance.

(2) Medial Offset

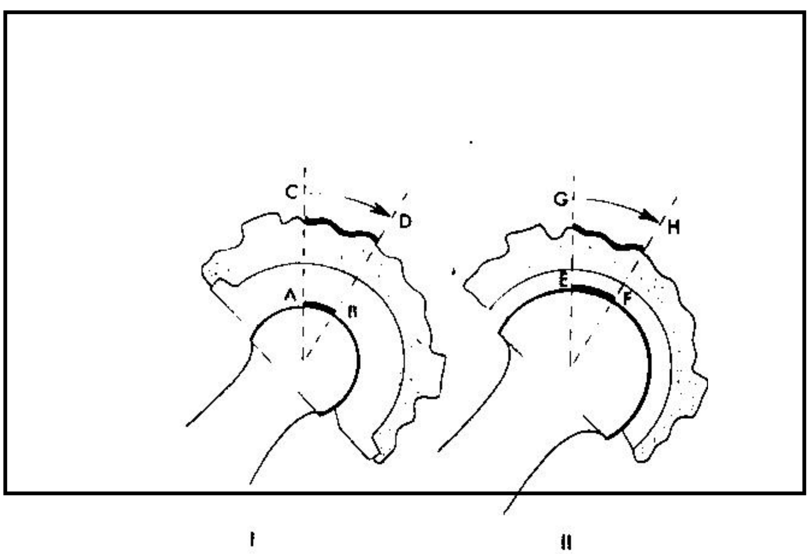
Medial offset is the distance from the center of the femoral head to a line through the axis of the distal part of the stem. Inadequate restoration of this offset shortens the moment arms of the abductor musculature and results in increased joint reaction force, limp and bony impingement which may result in dislocation. Conversely, an excessive increase in offset results in increased stresses within the stem and cement mantle that may lead to stem fracture or loosening.

(3) Version

Version refers to the orientation of the neck in reference to the coronal plane and is denoted as anteversion or retroversion. Restoration of femoral neck version is important in achieving stability of the prosthetic joint. The normal femur has 10 to 15 degrees of anteversion of the neck in relation to the coronal plane when the foot faces straightforward, and the prosthetic femoral neck should approximate this. Retroversion can result in posterior dislocation, especially when a posterior approach has been used. Anterior dislocation may occur with excessive anteversion of the prosthetic neck.



FEATURES OF FEMORAL COMPONENT



BIOMECHANICS OF SMALL AND LARGE HEADS AND CUPS

CEMENTLESS ACETABULAR COMPONENTS

Most cementless acetabular components are porous coated over their entire circumference for bone ingrowth. Fixation of the shell with transacetabular screws has become commonplace but carries some risk to intrapelvic vessels and viscera and requires flexible instruments for screw insertion. Pegs and spikes driven into prepared recesses in the bone provide some rotational stability but less than that obtained with screws. Other devices have an enlarged peripheral rim that can be press fitted without the need for ancillary fixation devices. Most systems feature a metal shell with an outside diameter of 40 to 75 mm that is used with a modular poly ethylene liner. With the combination, a variety of femoral head sizes, typically 22, 26, 28 and 32 mm can be accommodated according to the patient's need and the surgeons preference. The poly ethylene liner must be fastened securely to the metal shell. Some designs incorporate an elevation over a portion of the circumference of the rim, whereas others completely reorient the opening face of the socket upto 20 degree.

INDICATIONS FOR TOTAL HIP ARTHROPLASTY

Arthritis

- Rheumatoid
- Juvenile Rheumatoid
- Ankylosing spondylitis
- Degenerative joint disease
  - Primary
  - Secondary
- Avascular necrosis
  - Postfracture or dislocation
  - Idiopathic
  - Slipped capital femoral epiphysis
- Renal Disease
  - Cortisone induced
  - Alcoholism
  - Caisson disease
  - Lupus
  - Gaucher disease
  - Non union, femoral neck and trochanteric fractures
- Pyogenic arthritis or osteomyelitis
  - Hematogenous
  - Postoperative
- Tuberculosis
- Congenital subluxation or dislocation
- Hip fusion and pseudarthrosis

Failed reconstruction

- Osteotomy
- Cup arthroplasty
- Femoral head prosthesis
- Girdlestone procedure
- Total hip replacement
- Resurfacing arthroplasty

Bone tumor involving proximal femur or acetabulum

Hereditary disorders

Contraindications

Sepsis - Any localized or distal septic focus is an absolute contraindication

Unstable medical illnesses

Neuropathic arthropathy

Progressive Neurologic disorders

Absence or insufficiency of abductor musculature

Any process that is rapidly destroying bone

Obesity - Relative contraindication

PRE OPERATIVE EVALUATION

Since total hip arthroplasty is an elective surgery, a thorough preoperative evaluation must be done. The indication for the surgery must be reviewed first. The level of pain and disability, response to conservative therapy and desired life style must be considered.

The general condition of the patient including his physical and mental status, general medical condition and ability to withstand the surgery must be considered.

Physical examination should include spine and both upper and lower extremities including opposite hip, both knees and feet. Any limb length discrepancy and fixed deformities should be noted. Trendelenberg test to assess the abductor osseomuscular mechanism should be done. Aspirin and other anti-inflammatory drugs should be discontinued 7 to 10 days prior to surgery. Pyogenic lesions should be eradicated.

PRE OPERATiVE RADIOGRAPHIC ASSESSMENT

The goal of preoperative radiographic assessment is to confirm the diagnosis leading to surgical intervention, to determine the anatomic relationship of the femur and pelvis and to allow for accurate restoration of joint anatomy and biomechanics.

For primary total hip arthroplasty of a routine nature, the most important x - rays are the standard pelvic roentgenogram AP view with both hips and the lateral view of the hip and proximal femur. Position of hips in 15 degrees of internal rotation is essential to better delineate femoral geometry and offset.

OTHER SPECIAL STUDIES THAT MAY BE DESIRABLE INCLUDE THE FOLLOWING

X - rays of spine / knees

Oblique views of pelvis (in fracture-dislocations)

Bone Scans (Technetium, Gallium, Indium)

CT scans (in revisions / CDH / # dislocation)

PREOPERATiVE PLANNING

The general goals are:

- To determine the site and size of the implants
- To restore the anatomic and bio - mechanical center of rotation of the hip joint.
- To restore any limb length discrepancy
- To restore appropriate muscle relationship.
- To anticipate any problems likely to be met such as, deficiency of part of acetabulum requiring bone grafts or reinforcement rings along with plates and screws to fix the grafts, or the requirement of nonstandard sized implants (femoral).

Preoperative planning should include the use of plastic overlay templates supplied by the prostheses manufacturers. Templating aids in selection of the type of implant that will provide the best fit, implant size and neck length required to restore equal limb lengths and medial offset.

X rays should be taken with magnification markers and the corresponding templates used. Draw line at the level of and parallel to the ischial tuberosities and intersecting the lesser trochanter on each side. Compare the 2 points of intersection and measure the difference to determine the amount of shortening. Now place the acetabular template that matches the contour of acetabular subchondral bone most closely at 45 degrees of abduction. The inferomedial margin is at the level of the teardrop with full coverage of the cup. Mark the centre of the acetabular component on the radiographs. This will correspond to the new centre of rotation of the hip.

Place the femoral overlay templates on the film and select the size that most precisely matches the contour of the proximal canal and fills it most completely. Next, select the desired neck length to restore limb length and medial offset. If no shortening is present, then match the center of the head with the previously marked center of the acetabulum. If discrepancy exists, the distance between femoral head center and acetabulum centre should be equal to the previously measured limb length discrepancy. Once neck length is selected, mark the level of anticipated neck resection and measure the distance from the top of the lesser trochanter to use as a reference intraoperatively. Template the femur on the lateral view in a similar manner to assess whether the implant determined on the anteroposterior film can be inserted without excessive bone reaming.

SURGICAL PROCEDURE

PREPARATION OF PATIENT

On the day of the surgery, the skin is prepared using povidone iodine solution and covered with sterile clothes and brought to the theatre where the final preparation is done.

Prophylactic antibiotic is given on the table. We prefer a third generation cephalosporin in the dose of 1 gm given IV.

OPERATION THEATRE

Nowadays most total hip arthroplasties are being done in theatres with laminar flow, using body exhaust systems to reduce exogenous bacterial contamination. Adequate precautions are taken to maintain asepsis such as thorough fumigation, air conditioning, limiting the flow of traffic through the theatre to essential personnel only and use of prophylactic antibiotic.

ANESTHESIA USED AND POSITIONING

Epidural or General anesthesia is usually employed. The patient is then positioned lateral or supine according to the approach used.

LATERAL APPROACH (HARDINGE)

Place the patient supine with the greater trochanter at the edge of the table and the muscles of the buttocks freed from the edge. Make a posteriorly directed lazy-J incision centered over the greater trochanter. Divide the fascia lata in line with the skin incision and centered over the greater trochanter. Retract the tensor fasciae latae anterioly and the gluteus maximus posterioly exposing the origin of the vastus lateralis and the insertion of the gluteus medius. Incise the tendon of the gluteus medius obliquely across the greater trochanter leaving the posterior half still attached to the trochanter. Carry the incision proximally in line with the fibers of the gluteus medius at the junction of the middle and posterior thirds of the muscle. Distally, carry the incision anteriorly in line with the fibers of the vastus lateralis down to bone along the anterolateral surface of the femur. Elevate the tendinous insertions of the anterior portions of the gluteus minimus and vastus lateralis muscles. Abduction of the thigh then exposes the anterior capsule of the hip joint. Incise the capsule as desired. During closure, repair the tendon of the gluteus medius with nonabsorbable braided sutures.

ANTEROLATERAL APPROACH (SMITH-PETERSON)

Make the skin incision along the anterior third of the iliac crest and then along the anterior border of the tensor fasciae latae muscle; curve it posteriorly across the insertion of this muscle into the iliotibial band in the subtrochanteric region and end it there. Incise the fascia along the anterior border of the tensor fasciae latae muscle. Identify and protect the lateral femoral cutaneous nerve. Incise the muscle attachments to the lateral aspect of the ilium along the iliac crest to make reflection of the periosteum easier. Reflect it as a continuous structure, without fraying, distally to the superior margin of the acetabulum. Then divide the muscle attachments between the anterosuperior iliac spine and the acetabular labrum.

Inferiorly carry the fascial incision across the insertion of the tensor fasciae latae into the iliotibial band and expose the lateral part of the rectus femoris and the anterior part of the vastus lateralis muscles. Begin the capsular incision on the inferior aspect of the capsule just lateral to the acetabular labrum; extend it proximally, parallel with the acetabular labrum, to the superior aspect of the capsule, and then curve it laterally, continuing on beyond the capsule to the base of the greater trochanter. By reflecting it with the capsule, the capsular flap is reinforced and repair is thus made easier.

POSTERIOR APPROACH (MOORE)

The patient is placed in the lateral position or semiprone on the unaffected side. The incision begins 10 cm distal to the posterior superior iliac spine, extends laterally to the greater trochanter and then distally along the lateral thigh. The fascia lata is divided over the greater trochanter and continued proximally and distally in the line of the skin incision. The fibers of gluteus maximus are separated by blunt dissection, the posterior flap containing almost the entire muscle. Retracting this posterior flap and with further blunt dissection the sciatic nerve is identifiable in the depths of the incision. Stay sutures are placed through the tendons of piriformis and obturator internus and the short external rotators are divided close to their trochanteric insertions. While retracted posteriorly they serve as a soft tissue protection for the sciatic nerve. The capsule is incised posteriorly along the femoral neck. The hip may be dislocated by flexion, adduction and internal rotation.

IMPLANTATION OF CEMENTLESS ACETABULAR COMPONENTS

Attach the acetabular component to the positioning device included with the system instrumentation. Be certain of the means by which the positioning device orients the socket. Usually a rod emerging from the positioning device is oriented either parallel or perpendicular to the floor to dertmine the proper angle of abduction. An additional extension from the alignment device determines anteversion in relation to the axis of the trunk of the patient. The optimal inclination of the socket is 45 degrees. The optimal degree of anteversion is between 10 and 20 degrees. Carefully reassess the positioning of the socket before impaction because it can be extremely difficult to extricate if malpositioned. The edges of the component should match the angle of the patient's acetabular rim fairly closely. If they do not, carefully reassess the positioning of the patient and the insertion device. Maintain the alignment of the positioning device as the component is impacted into position. A change in pitch will be heard as the socket seats against subchondral bone. Reassess the positioning of the socket, and if satisfactory, remove the positioning device. Examine the subchondral bone plate through any available holes in the component to confirm intimate contact between implant and bone. If a gap is present impact the component further.

If screws are to be used for ancillary fixation, insert two screws through the shell, preferably in the posterosuperior quadrant. Use a flexible drill bit and a screwdriver to insert the screws from within the hole of the metal shell.

Insert the polyethylene liner, using whatever fixation means is specified in the technique manual. Be certain that no soft tissue becomes interposed between the polyethylene liner and its metal backing because this will prevent complete seating and engagement of the locking mechanism.

POSITION OF THE CUP

A line is drawn connecting the mouth of the acetabular cup and a horizontal line is drawn from the bottom of the tear drop of the pelvis. The angle formed between these lines is the position of the cup.

The position of the acetabular components are classified as

Neutral - $30\text{-}45^0$

Vertical - $>45^0$

Horizontal - $<30^0$

IMPLANTATION OF CEMENTLESS FEMORAL COMPONENTS

Insert the smallest reamer at a point corresponding to the piriformis fossa. The insertion point is slightly posterior and lateral on the cut surface of the femoral neck. An aberrant insertion point will not allow access to the center of the medullary canal. After the point of the reamer has been inserted, direct the handle laterally towards the greater trochanter. Aim the reamer down the femur towards the medial femoral condyle. If this cannot be accomplished, remove additional bone from the medial aspect of the greater trochanter, or varus positioning of the femoral component will result. Use rongeur, a box chisel, or a specialized trochanteric reamer for this purpose. Generally, a groove must be made in the medial aspect of the greater trochanter to allow proper axial reaming of the canal. Insert the reamer to a predetermined point. Most reamers are marked so as to be referenced against the tip of the greater trochanter or the femoral neck cut to determine the proper depth of insertion. Proceed with progressively larger reamers until firm cortical reaming is felt. Stop one size below the template femoral component size to avoid over reaming the distal canal. Assess the stability of the axial reamer within the canal.

Now proceed with preparation of the proximal portion of the femur. Remove the residual cancellous bone along the medial aspect of the neck with precision broaches. Begin with a broach at least two sizes smaller than the anticipated stem. Never use a broach larger than the last straight or flexible reamer used. Place the broach precisely in the same alignment as the axial reamers. Rotate the broach to control anteversion.

Seat the final broach to a point where it becomes axially stable within the canal and will not advance farther with even blow of the mallet. If adequate stability has been obtained, make the final adjustment of the neck cut. The final level of the neck cut should correspond with the level above the lesser trochanter determined by preoperative templating. Use trial stems with varying neck lengths. Evaluate the center of the femoral head relative to the height of the tip of the greater trochanter and compare the level to the template roentgenogram.

If the neck length appears satisfactory, proceed with a trial reduction of the hip. Perform this maneuver after full muscular relaxation has been obtained. Irrigate any debris out of the acetabulum. Use a plastic covered pusher that fits over the head of the femoral component to push the head into the socket. Take care not to use excessive force or place excessive torsion on the femur as the hip is reduced, or femoral fracture may occur.

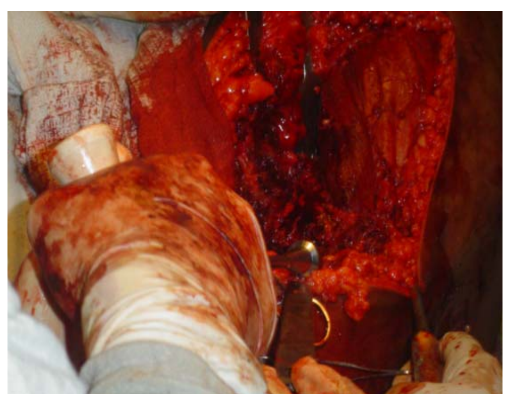
Now assess the stability of the joint. Move the hip through a range of motion. Note any areas of impingement between the femur and acetabulum with extremes of positioning. Insert the appropriate size femoral component. Insert the stem to within a few centimeters of complete seating by hand. Be certain to reproduce the precise degree of anteversion determined by the driving device providing with the system or a plastic tipped pusher. Use blows of equal force as the component is seated. As the component nears complete seating, it will advance in smaller increments with each blow of the mallet. An audible change in pitch usually can be detected as the stem nears final seating. Place the prosthetic head of appropriate size and neck length onto the stem and affix it with a few blows of a mallet over a plastic capped head impactor. Use only the femoral heads specifically designed to mate with the stem. Remove any debris from the acetabulum and again reduce the hip. Make sure that no soft tissues have been reduced into the joint. Confirm the stability of the arthroplasty through a full range of motion.

INSTRUMENTS

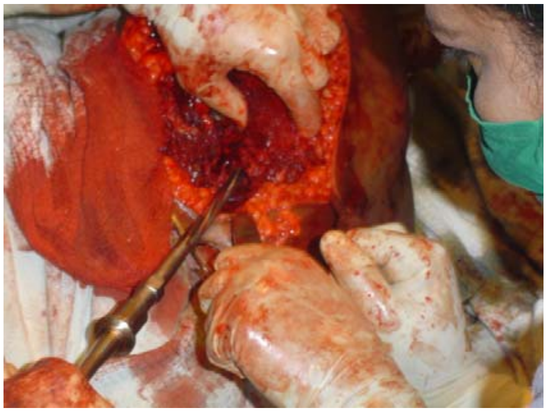
SUPINE POSITION

LATERAL APPROACH INCISION

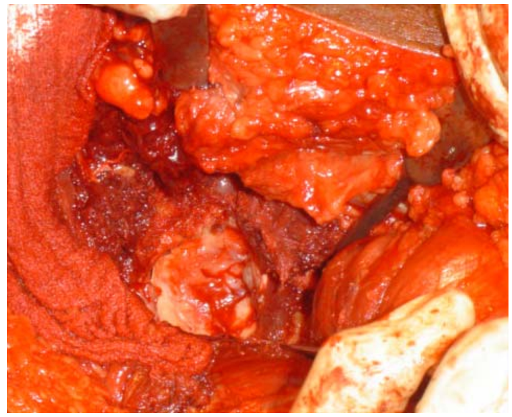
LATERAL APPROACH EXPOSURE



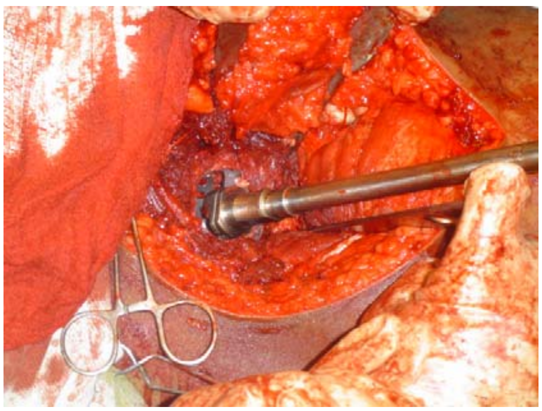
FEMORAL CANAL INITIATION



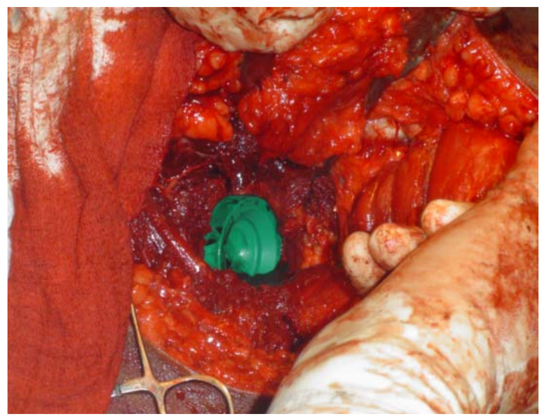
MEDULLARY CANAL REAMING



ACETABULUM EXPOSURE

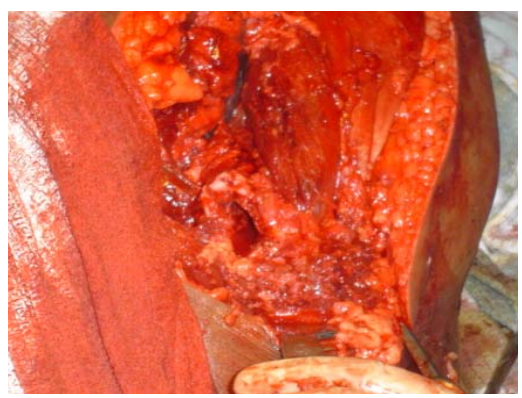


ACETABULUM PREPARATION

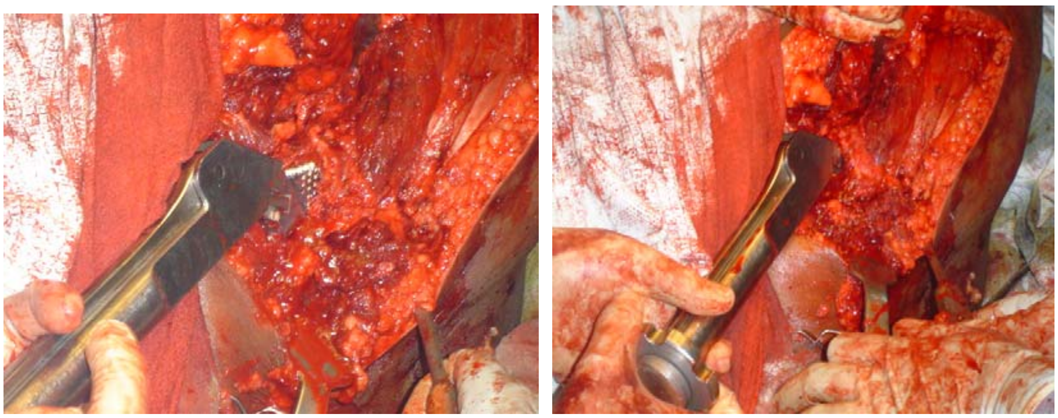


ACETABULUM TRIAL CUP INSERTION

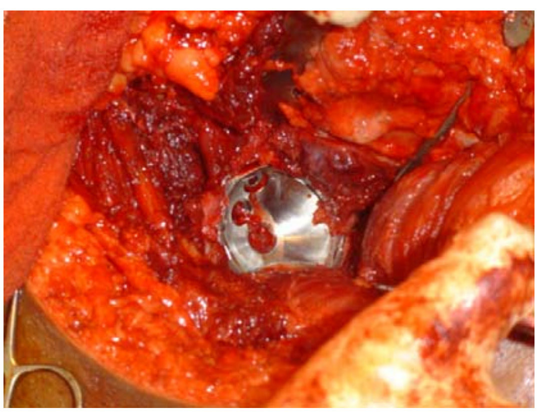
METAPHYSEAL PREPARATION



AFTER PREPARATION

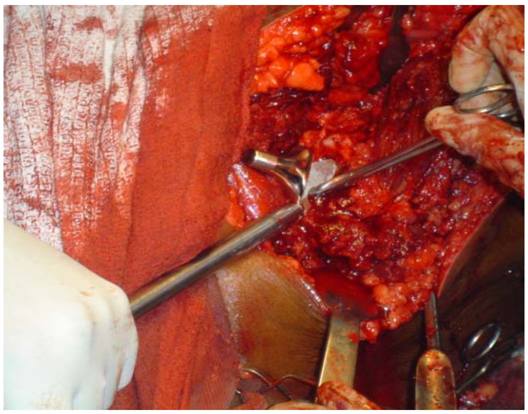


FEMORAL BROACH INSERTION

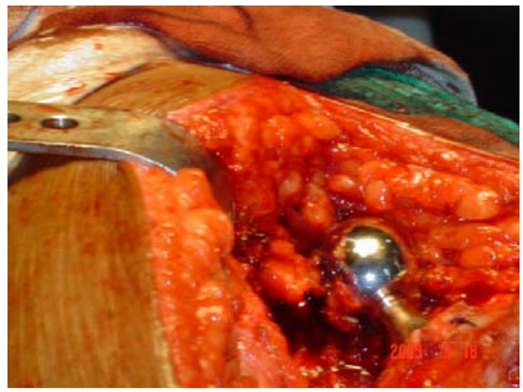


ACETABULAR SHELL FIXATION

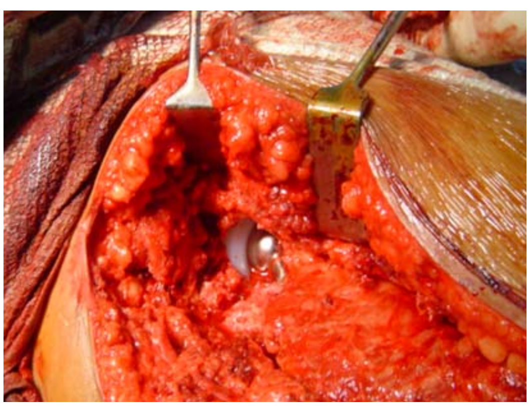
POLYETHYLENE LINER INSERTION



FEMORAL STEM INSERTION



FEMORAL HEAD INSERTION



AFTER REDUCTION

AFTER CLOSURE

Materials and Methods

MATERIALS AND METHODS

This is a prospective study conducted at Department of Orthopaedic Surgery, Government General Hospital, Chennai-3 during the period from September 2003 to February 2006. We had done 31 porous-coated uncemented total hip replacement surgeries in 29 patients for a variety of indications.

SEX RATIO:

Sex	*No. of Patients*	*Percentage*
Male	16	55%
Female	13	45%

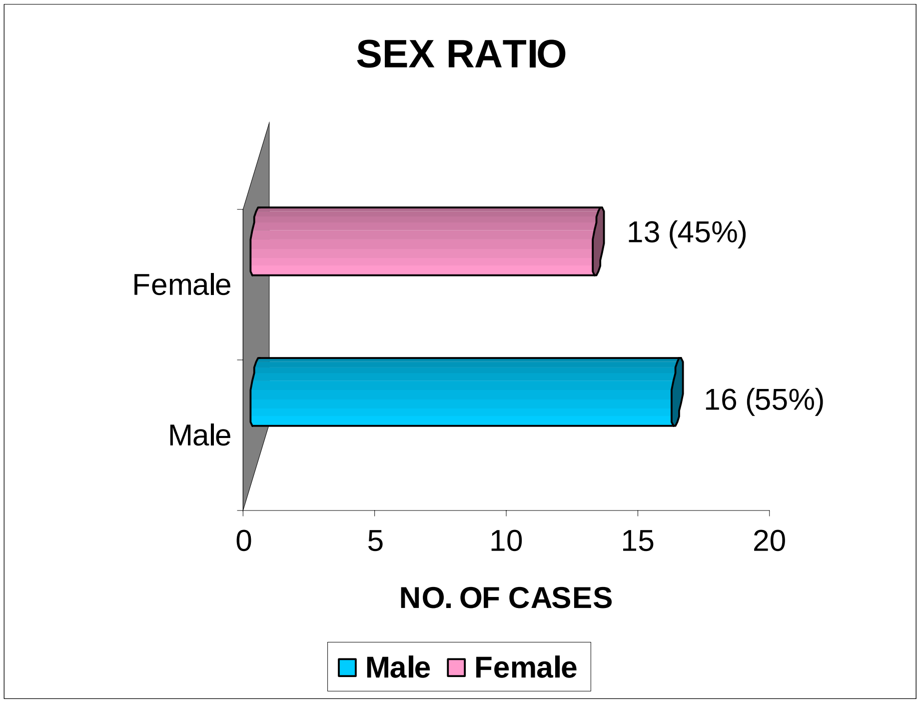
AGE INCIDENCE:

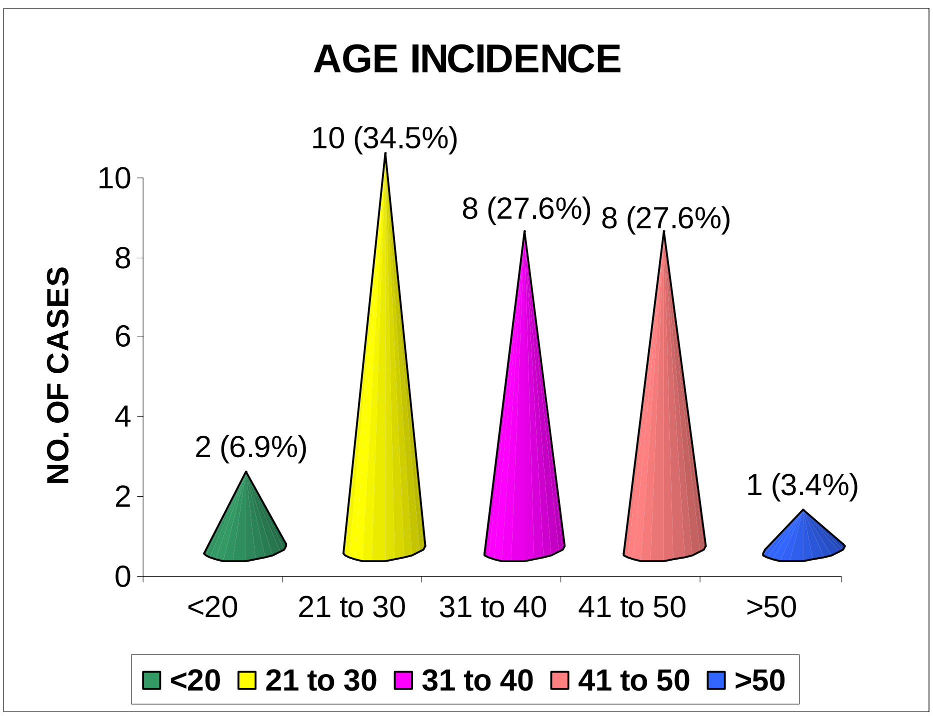
Age Group	*No. of Patients*	*Percentage*
$\leq$20	2	6.9%
21-30	10	34.5%
31-40	8	27.6%
41-50	8	27.6%
>50	1	3.4%

The average age at the time of surgery was 34.7 years (range, 13-66 years).

SIDE INVOLVED:

Side	*No. of Hips*	*Percentage*
Right	13	42%
Left	18	58%





INDICATIONS FOR SURGERY:

Indications	*No. of Cases*	*Percentage*

Chronic Arthritis	13	44.8%
Avascular Necrosis	6	20.8%
Rheumatoid Arthritis	4	13.8%
Fracture Neck of femur	4	13.8%
Ankylosing Spondylitis	1	3.4%
TB Arthritis	1	3.4%

Preoperatively, all the patients were evaluated using Harris Hip score. The preoperative score ranged from 11-46, with an average of 24.

SURGICAL APPROACHES USED:

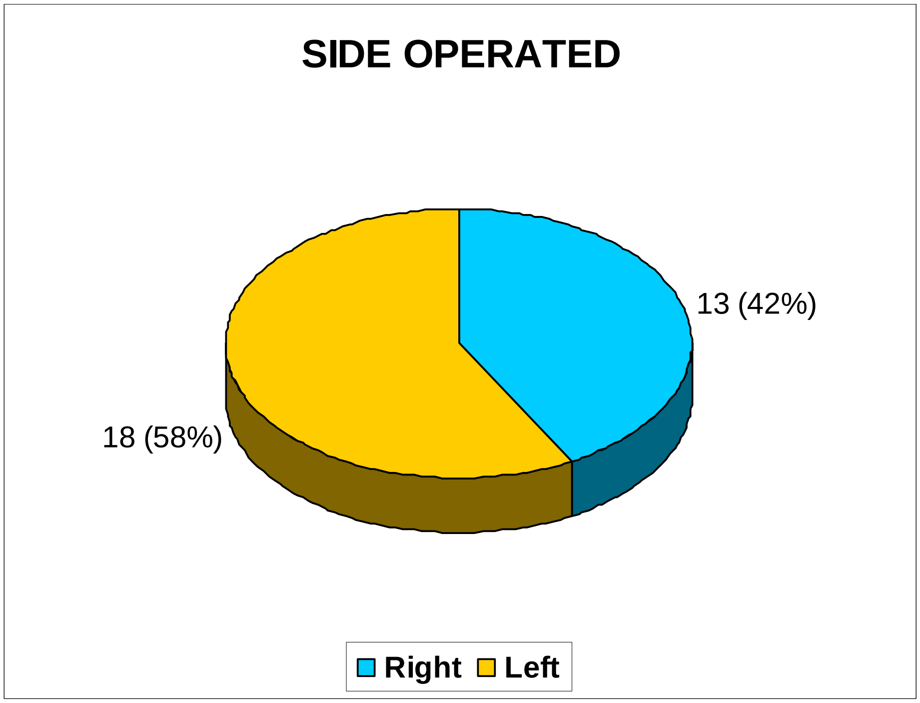
Approach	*No. of Hips*	*Percentage*
Lateral	28	90.3%
Anterolateral	3	9.7%

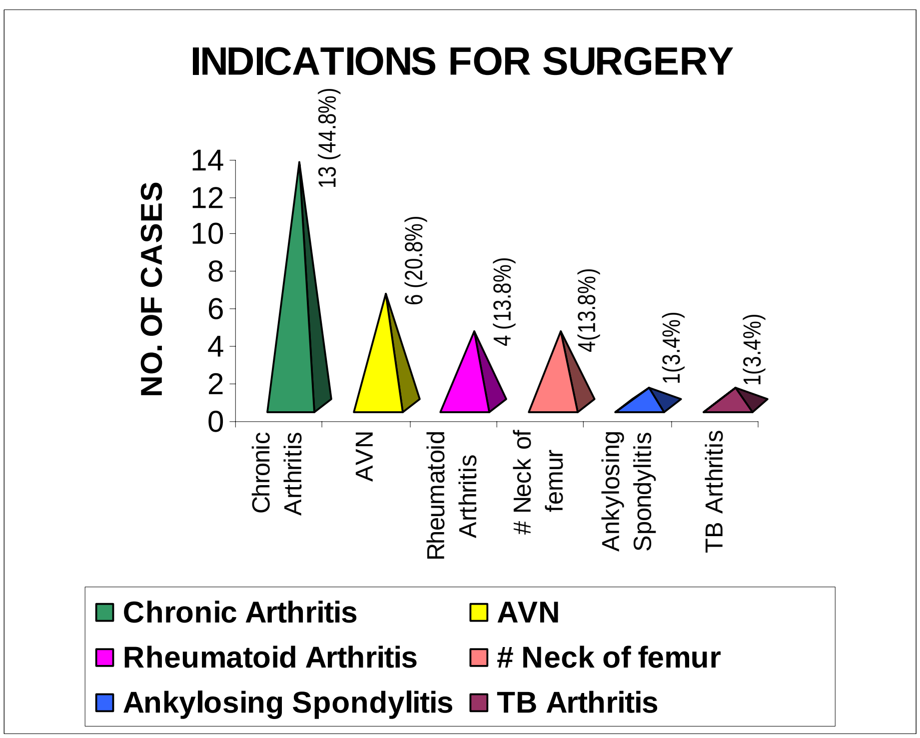
POSITION OF PATIENT DURING SURGERY:

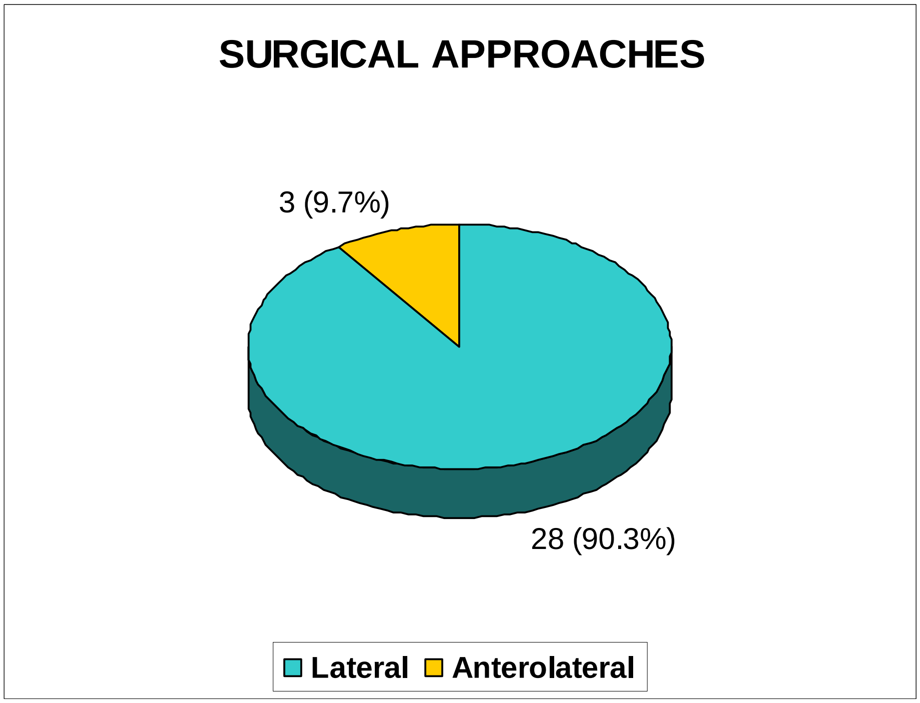
Position	*No. of Hips*	*Percentage*
Supine	23	74%
Lateral	8	26%

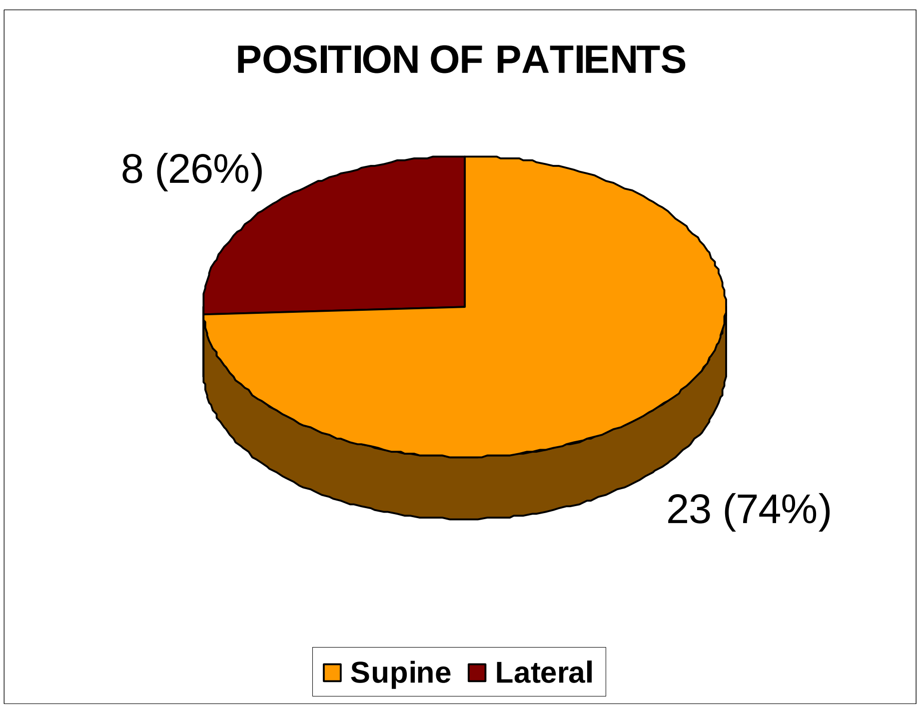
IMPLANT USED:

Implants	*No. of Hips*	*Percentage*
AML System	23	74%
SL - Plus System	8	26%


SIDE OPERATED
13 (42%)
18 (58%)
Right
Left


INDICATIONS FOR SURGERY
NO. OF CASES
0
2
4
6
8
10
12
14
13 (44.8%)
6 (20.8%)
4 (13.8%)
4(13.8%)
1(3.4%)
1(3.4%)
Chronic Arthritis
AVN
Rheumatoid Arthritis
Neck of femur
Ankylosing Spondylitis
TB Arthritis
Chronic Arthritis
AVN
Rheumatoid Arthritis
Neck of femur
Ankylosing Spondylitis
TB Arthritis


SURGICAL APPROACHES
3 (9.7%)
28 (90.3%)
Lateral
Anterolateral


POSITION OF PATIENTS
8 (26%)
23 (74%)
Supine
Lateral

AML femoral stem is a straight, symmetrical stem. The surface of the stem is extensively porous-coated. The average pore size is 250 microns. The stem features a self-locking taper which accepts various sizes of femoral head. The head is made of Zirconia, the toughest and smoothest orthopaedic ceramic. The Duraloc acetabular shell is primarily fixed with poro-coat and additionally with cancellous screws and duraloc polyethylene liner is used.

SL-Plus non-cemented stem system comprises a double-cone straight stem with a rectangular cross-section. The stability of primary fit of PLUS-FIT cup is enhanced by triple radius profile, and exact conformity between the smooth inside of the cup shell and the PE insert.

POST OP PROTOCOL:

The patients were nursed in post operative ward with the hip positioned in approximately 15 degrees of abduction using abduction pillow in the immediate post operative period.

Bed exercises and limited mobilization was started on the first post operative day. Deep breathing, quadriceps and gluteal isometrics and gentle rotation exercises were begun. Drains were removed between 24 and 48 hours after surgery. Antibiotics were given parenterally for first 5 days and then orally for next 5 days. Suture removal was done between 10 and 12 days postoperatively.

The patients were allowed protected weight-bearing for approximately 12 weeks. This includes a six weeks on a pair of crutches or walker and another six weeks on either one crutch or one cane. The duration of protected weight bearing is dependent upon the following 3 factors:

1. Bone quality
2. Estimate of tightness of fit of implants during surgery.
3. Appearance of immediate post-operative x-rays.

Patients were instructed to use an elevated toilet seat and to use one or two ordinary pillows between the knees when lying on the unoperated side and not to sit cross leg in the floor.

FOLLOW-UP:

The patients were reviewed regularly at 1 month interval for first 3 months, then at 6 months, 1 year and periodically thereafter for every 6 months. At the end of this study the patients were called back for review. Patients were reassessed clinically using the Harris hip score. X-rays of the hip were taken and were compared with the initial x-rays for signs of loosening, migration, wear and implant failure.

The duration of follow up at the end of this study ranged from 4-30 months, with an average of 20.3 months.

Results

RESULTS

In this study, we have analysed the functional results of the porous-coated uncemented total hip arthroplasty, done in 31 hips of 29 patients, in Government General Hospital, Chennai during the period September 2003 to February 2006.

All patients were evaluated clinically and radiologically preoperatively and at various followup periods. All the patients were analysed using Harris Hip Score evaluation, preoperatively and post operatively.

In our study, 15 hips showed excellent results, 10 hips showed good results, 3 hips showed fair results and 3 hips showed poor results.

At the end of our study, the results are:

Results	***No. of hips***	***Percentage***
Excellent	15	48.4%
Good	10	32.2%
Fair	3	9.7%
Poor	3	9.7%

All the patients were analysed radiographically also during various follow up periods. The femoral stem and acetabular cup were assessed for its position, loosening, migration or implant failure.

HARRIS HIP EVALUATION (MODIFIED)

PAIN
- ☐ None or ignores it (44)
- ☐ Slight, occasional, no compromise in activities (40)
- ☐ Mild pain, no effect on average activities, rarely moderate pain with unusual activity; may take aspirin (30)
- ☐ Moderate pain, tolerable but makes concessions to pain; some limitation of ordinary activity or work; may require occasional pain medicine stronger than aspirin (20)
- ☐ Marked pain, serious limitation of activities (10)
- ☐ Totally disabled, crippled, pain in bed, bedridden (0)

LIMP
- ☐ None (11)
- ☐ Slight (8)
- ☐ Moderate (5)
- ☐ Severe (0)

SUPPORT
- ☐ None (11)
- ☐ Cane for long walks (7)
- ☐ Cane most of the time (5)
- ☐ One crutch (3)
- ☐ Two canes (2)
- ☐ Two crutches (0)
- ☐ Not able to walk (0)

DISTANCE WALKED
- ☐ Unlimited (11)
- ☐ Six blocks (8)
- ☐ Two or three blocks (5)
- ☐ Indoors only (2)
- ☐ Bed and chair (0)

STAIRS
- ☐ Normally without using a railing (4)
- ☐ Normally using a railing (2)
- ☐ In any manner (1)
- ☐ Unable to do stairs (0)

PUT ON SHOES AND SOCKS
☐ With ease (4) ☐ With difficulty (2) ☐ Unable (0)

SITTING
- ☐ Comfortably in ordinary chair one hour (5)
- ☐ On a high chair for one-half hour (3)
- ☐ Unable to sit comfortably in any chair (0)

Enter public transportation (1): ☐ Yes ☐ No

Flexion contracture: ________ (degrees)

Leg length discrepancy: ________ (cm)

ABSENCE OF DEFORMITY (All Yes = 4; Less Than 4 = 0)
- Less than 30° fixed flexion contracture: ☐ Yes ☐ No
- Less than 10° fixed adduction: ☐ Yes ☐ No
- Less than 10° fixed internal rotation in extension: ☐ Yes ☐ No
- Limb length discrepancy less than 3.2 cm: ☐ Yes ☐ No

RANGE OF MOTION (*Normal)
Total degree measurements, then check range to obtain score
Flexion (*140°): ________ External rotation (*40°): ________
Abduction (*40°): ________ Internal rotation (*40°): ________
Adduction (*40°): ________

RANGE-OF-MOTION SCALE:
211°-300° (5) 61°-100° (2)
161°-210° (4) 31°-60° (1)
101°-160° (3) 0°-30° (0)

Range-of-Motion Score: ________

Total Harris Hip Score: ________

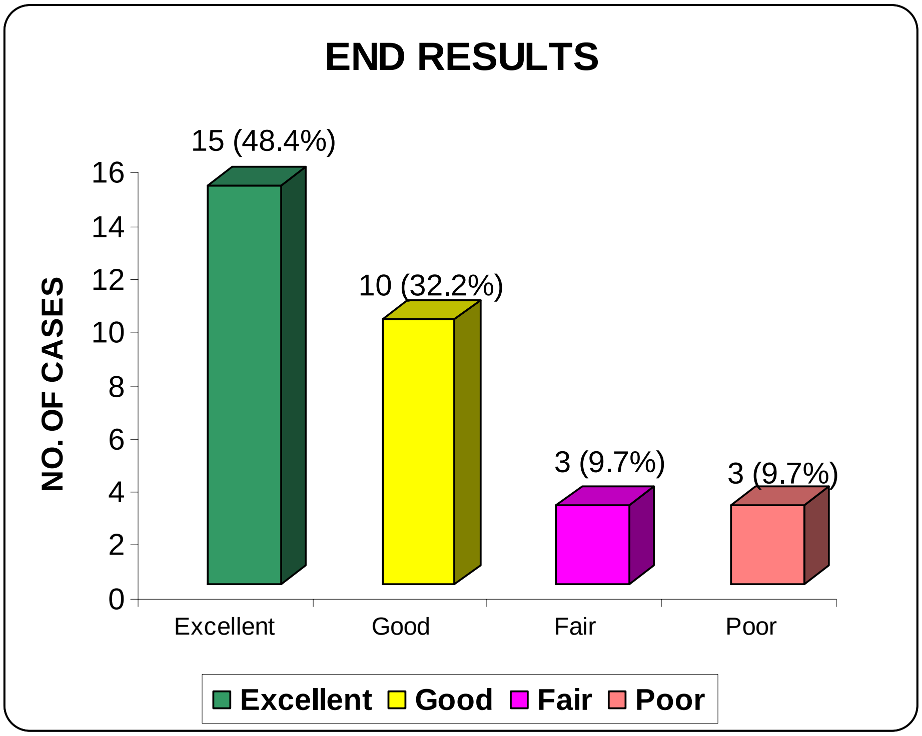
Readmission to Hospital: ☐ Yes ☐ No
Date of Readmission: ___/___/___
Implant Removal Date: ___/___/___

Comments: ____

Investigator Signature: ______________________ **Date:** ___/___/___ (mm/dd/yy)

Based on the Harris Hip Score (HHS), the results were divided into excellent, good, fair and poor as below:

Excellent	:	$\geq$ 90 points
Good	:	80-89 points
Fair	:	70-79 points
Poor	:	<70 points


END RESULTS
NO. OF CASES
0
2
4
6
8
10
12
14
16
15 (48.4%)
10 (32.2%)
3 (9.7%)
3 (9.7%)
Excellent
Good
Fair
Poor
Excellent
Good
Fair
Poor

In our study, one patient had subsidence of femoral stem of 3 mm in the proximal portion and the patient had thigh pain. One patient had migration of acetabular cup medially through the floor of the acetabulum.

CORRELATION BETWEEN STATE OF FEMORAL COMPONENT AND POSITION OF FEMORAL STEM

Position of femoral stem	*Condition of the femoral stem*		*% of Loose femoral component*
	Non-Loose	*Loose*	
Valgus	-	-	0%
Varus	-	-	0%
Neutral	30	1	3.2%

CORRELATION BETWEEN STATE OF ACETABULAR COMPONENT AND POSITION OF THE CUP

Position of acetabular component	*Condition of the acetabular component*		*% of Loose acetabular component*
	Non-Loose	*Loose*	
Neutral	30	-	0%
Vertical	-	-	0%
Horizontal	-	1	3.2%

Harris hip score at the end of our study ranges from 65-98, with the average score of 87.

CORRELATION BETWEEN PRIMARY INDICATION AND HIP SCORE

Indications	*Pre Operative*	*Post Operative*	*Improvement*
Chronic Arthritis	23.7	83.1	59.4
Rheumatoid arthritis	23.0	89.0	66.0
Avascular Necrosis	28.3	91.7	63.4
Fracture Neck of femur	23.0	88.0	65.0
Ankylosing Spondylitis	17.0	94.0	77.0
TB Arthritis	15.0	81.0	66.00

In our study, we have not found any correlation between the indications of the surgery and the results.

COMPLICATIONS:

In our study, the following complications were noted.

1. *Subcutaneous Infection:*

Two patients had infections over the suture line. It required pus culture and sensitivity tests. With appropriate antibiotics, the wounds healed by secondary intention.

2. *Dislocation:*

One patient had dislocation of hip in immediate post operative period due to vertical placement of acetabular cup. This patient was reoperated and cup repositioning was done.

3. *Malposition of implant:*

It occurred in one patient. The acetabular shell was malpositioned in false acetabulum. Revision total hip arthroplasty with allografting of acetabulum was done for this patient.

4. *Subluxation:*

It occurred in one case and treated with derotation boot and physiotherapy.

5. *Intraoperative trochantenic fractures:*

It occurred in one case. Peroperatively, the hip was not reducible and during manipulation, greater trochanter splintered. Cerclage wiring was done and the patient was allowed full weight-bearing after union of fracture.

6. *Sciatic Nerve palsy:*

One patient had sciatic nerve palsy since the immediate post operative period. The patient is using foot drop stop splint.

7. *Subsidence:*

One patient had subsidence of femoral stem during the followup visit at 21 months. She had thigh pain.

8. *Migration of Implant:*

Medial migration of acetabular cup through the acetabular floor occurred in one case.

9. *Limb length discrepancy:*

Three patients had limb length discrepancy. One patient had 2cm shortening and two patients had 1.5cm shortening, for which heel and sole raise footwear was prescribed. One patient had 2cm false lengthening since she had malunited subtrochantenic fracture in the opposite limb.

Complications	*No. of hips*	*Percentage*
Subcutaneous infection	2	6.5%
Dislocation	1	3.2%
Malposition	1	3.2%
Subluxation	1	3.2%
Intraoperative fracture femur	1	3.2%
Sciatic Nerve palsy	1	3.2%
Subsidence of femoral stem	1	3.2%
Migration of acetabular cup	1	3.2%
Limb length discrepancy	3	9.7%

Illustrative Cases

CASE – 1

This 30 years old female, presented with chronic nonspecific arthritis of right hip of 2 years duration of illness. The preoperative hip score was 38. She underwent THR on 10.10.03. Patient recovered postopertively uneventfully with the post operative hip score of 93 at 29 months of follow up. The result was excellent.

CASE - 1

PRE OP

POST OP

12 MONTHS FOLLOW UP

29 MONTHS FOLLOW UP

29 MONTHS FOLLOW UP - RANGE OF MOVEMENTS

CASE – 2

This 46 years old male had sustained fracture neck of femur in his left hip and taken native treatment. He presented to us after one year of injury with nonunion of fracture neck of femur. He was put on skeletal fraction preoperatively. The preoperative hip score was 20. He was operated on 04.03.04. He recovered uneventfully in the postoperative period. The post operative hip score at 24 months of follow up was 97 and the result was excellent.

CASE - 2

PRE OP

POST OP

24 MONTHS FOLLOW UP

24 MONTHS FOLLOW UP - RANGE OF MOVEMENTS

CASE – 3

This 20 years old female, presented with chronic arthritis of right hip with the preoperative hip score 27. She underwent THA on 15.04.04. Post operatively she recovered well. The postoperative hip score was 92 at 23 months of followup. The result was excellent.

CASE - 3

PRE OP

POST OP

12 MONTHS FOLLOW UP

23 MONTHS FOLLOW UP

23 MONTHS FOLLOW UP - RANGE OF MOVEMENTS

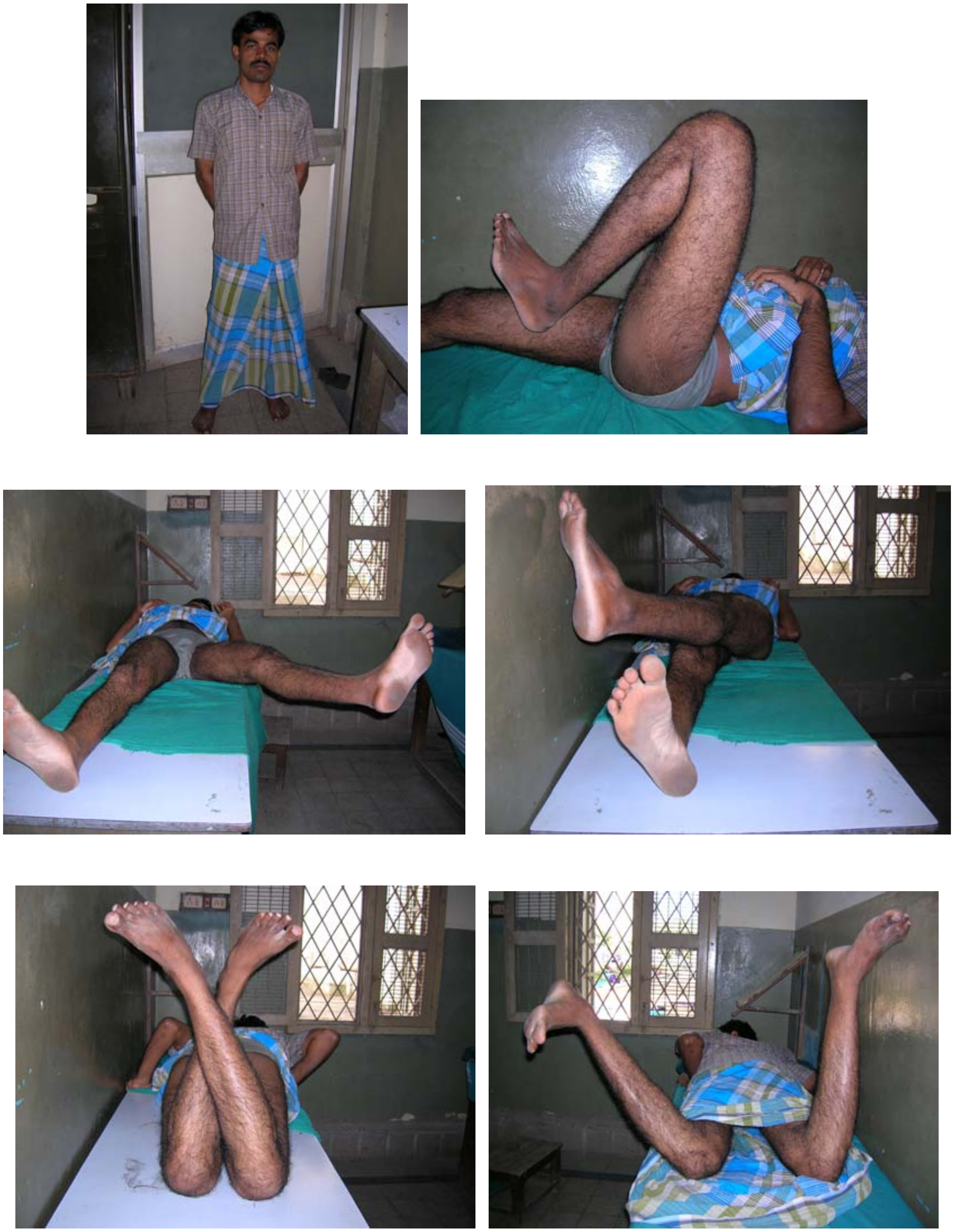
CASE – 4

This 23 years old male had ankylosing spondylitis involving the left hip. The pre operative hp score was 17. He underwent surgery on 16.10.03. He recovered uneventfully in the post operative period and the post operative hip score at 29 months of follow up was 94. The result was excellent.

CASE - 4

PRE OP

POST OP **29 MONTHS FOLLOW UP**



29 MONTHS FOLLOW UP - RANGE OF MOVEMENTS

CASE – 5

This 42 years old male had avascular necrosis head of femur in right hip. The preoperative hip score was 38. We had done uncemented THR right hip on 11.09.03. In the immediate post operative period, patient had dislocation of the hip, propably due to vertical cup placement. The patient was reoperated on 11.10.03. Patient recovered uneventfully. The post operative hip score after 30 months of follow up was 98 and the result is excellent.

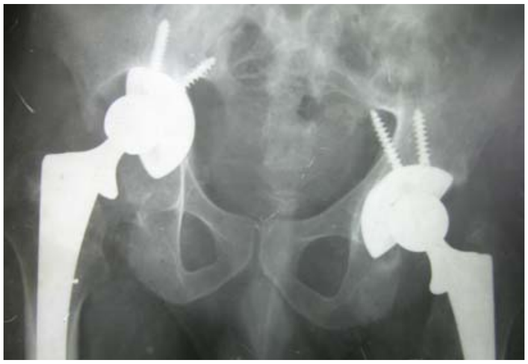
CASE - 5

PRE OP **POST OP**

AFTER RESURGERY **30 MONTHS FOLLOWUP**

30 MONTHS FOLLOW UP - RANGE OF MOVEMENTS

COMPLICATIONS



MALPOSITION OF ACETABULAR CUP

AFTER REVISION THR

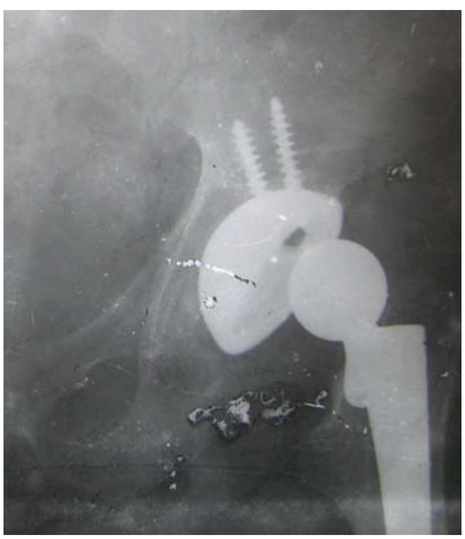
DISLOCATION OF HIP

AFTER REPOSITIONING OF CUP

COMPLICATIONS

PER OPERATIVE
IRREDUCIBILITY OF HIP

INTRA OPERATIVE
TROCHANTERIC FRACTURE



SUBLUXATION OF HIP

SUBSIDENCE OF FEMORAL STEM

MEDIAL MIGRATION OF ACETABULAR CUP

SUPERFICIAL INFECTION

SCIATIC NERVE PALSY

Discussion

DISCUSSION

Uncemented total hip replacement is the procedure of choice for younger individuals in whom total hip replacement is contemplated. The first generation cementless implants were associated with a high incidence of thigh pain, aseptic loosening, stress shielding and osteolysis. With the advancement and refining of implant designs and materials, the new generation cementless implants, which are commonly porous coated, are associated with less incidence of complications and provide better results.

Y.H. Kim et al., from the Ewha Womans University College of Medicine, Seoul, Korea, prospectively analysed the long term results of the cementless porous-coated anatomic total hip prosthesis in 119 patients (131 hips), surgeries done between January 1984 and January 1986.

Since the materials and methods used for the analysis were similar to our study, this study was chosen for the comparison of results of our study.

M.J. Bryant, W.G. Kernohan, J.R. Nixon and R.A.B. Mollan from Musgrave Park Hospital, Belfast of Northern Ireland, analysed 13 methods of hip scoring systems in the postoperative assessment of 47 hip arthroplasties. They concluded that three essential variables for measurement appear to the walking distance, hip flexion and pain, and these three variables should be recorded separately.

Since Harris Hip score system includes all the essential criteria with adequate weightage for functional assessment, it is widely accepted as a good scoring system and we have also used this in our study.

In Kim et al., study, the preoperative hip score ranged from 12 to 74 with an average of 55, compared to the preoperative hip score ranging from 11 to 46, with an average of 24 in our study. The lesser preoperative Harris hip score in our study may be due to the fact that Indian patients go in for Joint replacement surgery only after advanced changes in the joint.

The mean age of the patients at surgery was 48.4 years (range, 19 to 69), compared to 34.7 years (range, 13 to 66) in our study.

The common indications for the surgery were avascular necrosis of femoral head in 62 hips (47%), arthritis in 33 hips (25%) and fractures of neck of femur in 27 hips (21%).

In our study, the common indications were following arthritis in 17 hips (58.6%), avascular necrosis in 6 hips (20.8%) and fractures of neck of femur in 4 hips (13.8%).

The mean clinical and radiological followup was 19.4 years (range, 18 to 20) compared to 20.3 months (range, 4 to 30 months) in our study.

Since ours is a short term study, we have taken the 2 years followup results of Kim et al., study for the comparison and analysis of the results.

After 2 years of followup of 128 hips, the results were excellent in 96 hips (75%), good in 24 hips (19%), fair in 8 hips (6%) and poor in none of the hips (0%), with the mean postoperative Harris hip score of 95 (range, 75 to 100).

In our study, after 20.3 months of mean followup, the results were excellent in 15 hips (48.4%), good in 10 hips (32.2%), fair in 3 hips (9.7%) and poor in 3 hips (9.7%), with the mean post operative Harris hip score of 87 (range, 65-98).

The poor results in three patients in our study are due to malposition of the implant, migration of the implant and bilateral hip disease.

After 19.4 years of followup (in Kim et al., study), the results were excellent in 64 hips (58%), good in 8 hips (7%), fair in 6 hips (6%) and poor in 32 hips (29%), with the mean hip score of 85 (range, 45 to 100). In most cases, this could be attributed to age - related deterioration in function.

In this study, 29 hips (22%) had childhood pyogenic or tuberculous arthritis, and none was revised for infection. In our study, we had operated a case of tuberculous arthritis under anti-tuberculous chemotherapy cover, and no reactivation or infection was seen.

Kim et al., (1987) treated 38 cases of tuberculous arthritis with total hip replacement with quiescent period ranging from 3months to 45 years. Intraoperative culture was positive in 4 cases. No reactivation of disease was seen in these cases. He recommended anti - tuberculous chemotherapy for 3 weeks preoperatively and for 6 to 9 months postoperatively.

Teak Rim Yoon, Sung Man Rowe, Iwan Budiwan Anwar and Jae Yoon Chung treated tuberculous hips with one stage total hip replacement and anti-tuberculous chemotherapy. No signs of reactivation was seen after mean followup of 3 years.

Total hip arthroplasty appears to be a safe procedure for patients who have quiescent as well as active tuberculosis of the hip when there is no gross evidence of infection.

With his study, Kim et al., suggested that uncemented acetabular components with polyethylene of better quality and a better capturing mechanism, or with alternative bearing surfaces such as ceramic - on - ceramic, may provide longer lasting results.

In our series, dislocation of the hip occurred in one case due to vertical placement of acetabular cup. It may be due to improper positioning of the patient and insufficient three-dimensional orientation of the surgeon.

Migration of the acetabular cup medially occurred in one case due to poor bone stock with osteoporosis. One patient had subluxation of femoral head in the immediate postoperative period, probably due to abductor weakness.

Although wear of the bearing surface continues to limit the long - term success rate of arthroplasty, there is a predictable long term stability of the bone implant interface achieved with cementless fixation.

CONCLUSION

The uncemented total hip arthroplasty is the best choice of surgery for hip diseases in younger individuals with good bone quality. The learning curve for the total hip arthroplasty to produce better results of this surgery is fairly big.

The use of porous coated implants had better primary stability and also later with bone ingrowth, superior bond strength at the implant interface. This allows the porous coat to withstand loads which, in other systems, might result in a breakdown of surface coating. The bond strength and high coefficient of friction assure rigid, mechanical stability which is an essential factor for bone ingrowth.

The preferred surgical approach is by lateral Hardinge approach and the position is supine position, especially for the surgeons in the learning curve, since the surgeon will have better three-dimensional orientation.

The success of hip arthroplasty is predicted on proper patient selection, use of well designed implants and skilled technical execution of the procedure.

As this is only a short term study, further followup and evaluation is essential to come out with a definitive conclusion.

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Master chart

S.No	Name	Age	Sex	I.P. NO	Diag-nosis	Side	PRE OP ROM						APP	POST OP ROM						ACETABULAR CUP ASSESSMENT				FEMORAL STEM ASSESSMENT				Comp	GAIT		HIPSCORE			FO-UP Mths	Results	Remarks
																				IMM		FO-UP		IMM		FO-UP			PRE	PST	PRE	PST	IMP			
							FL	EX	AB	AD	IR	ER		FL	EX	AB	AD	IR	ER	Pos	Los	Pos	Los	POS	Los	Pos	Los									
1.	Ramalinga Jothi	29	M	602132	CA	R	20	0	20	15	5	5	LAT	70	20	45	20	20	30	Mal	–	Neu	–	Neu	–	Neu	–	Mal, Sup Inf	ANT	N	19	69	50	27	Poor	Revision THA Rt. Hip done
				628650	CA	L	30	0	20	20	10	5	LAT	60	20	50	20	20	40	Neu	–	Neu	–	Neu	–	Neu	–	LLD	ANT	N	19	76	57	30	Fair	-
2.	Balasubramaniam	42	M	604111	AVN	R	105	0	20	20	20	20	LAT	80	20	50	30	30	40	Ver	–	Neu	–	Neu	–	Neu	–	DIS	ANT	N	38	98	60	30	Excellent	Resurgery done
3.	Ananthi	42	F	614877	FNF	L	40	10	50	20	20	20	LAT	40	20	50	30	5	25	Hor	-	Hor	+	Neu	-	Neu	-	MIG	ANT	N	17	68	51	30	Poor	Planning for revision
4.	Ammu	30	F	620322	CA	R	80	20	40	30	10	10	LAT	90	30	50	30	15	45	Neu	-	Neu	-	Neu	-	Neu	-	-	ANT	N	38	93	55	29	Excellent	-
5.	Arunagiri	23	M	619380	AS	L	10	-	0	0	0	0	LAT	100	25	45	30	45	20	Neu	-	Neu	-	Neu	-	Neu	-	-	ANT	N	17	94	77	29	Excellent	-
6.	Velayutham	35	M	611529	RA	R	70	10	0	0	0	0	LAT	90	20	40	30	25	40	Neu	-	Neu	-	Neu	-	Neu	-	-	ANT	N	26	88	62	28	Good	-
7.	Sridhar	30	M	624072	AVN	L	50	10	60	5	0	0	LAT	90	20	60	20	20	30	Neu	-	Neu	-	Neu	-	Neu	-	-	ANT	N	35	94	59	28	Excellent	-
8.	Kalaiarasan	33	M	624929	AVN	R	40	10	30	30	10	10	ANT LAT	70	20	50	20	20	20	Neu	-	Neu	-	Neu	-	Neu	-	-	ANT	N	35	93	58	28	Excellent	-
9.	Rajammal	45	F	623028	CA	L	30-100	-	20-50	-	-	25-30	LAT	70	25	40	30	20	30	Neu	-	Neu	-	Neu	-	Neu	-	-	ANT	N	27	84	57	27	Good	-
10.	Palanisamy	50	M	631010	RA	L	15-90	-	20-30	-	0	0	LAT	70	20	40	30	20	30	Neu	-	Neu	-	Neu	-	Neu	-	-	ANT	N	30	88	58	27	Good	-
11.	Paul Raj	28	M	630736	FNF	L	70	10	20	20	20	20	LAT	70	25	50	30	20	45	Neu	-	Neu	-	Neu	-	Neu	-	-	ANT	N	46	96	50	27	Excellent	-

S.No	Name	Age	Sex	I.P. NO	Diag-nosis	Side	PRE OP ROM FL	PRE OP ROM EX	PRE OP ROM AB	PRE OP ROM AD	PRE OP ROM IR	PRE OP ROM ER	APP	POST OP ROM FL	POST OP ROM EX	POST OP ROM AB	POST OP ROM AD	POST OP ROM IR	POST OP ROM ER	ACETABULAR CUP ASSESSMENT IMM Pos	ACETABULAR CUP ASSESSMENT IMM Los	ACETABULAR CUP ASSESSMENT FO-UP Pos	ACETABULAR CUP ASSESSMENT FO-UP Los	FEMORAL STEM ASSESSMENT IMM POS	FEMORAL STEM ASSESSMENT IMM Los	FEMORAL STEM ASSESSMENT FO-UP Pos	FEMORAL STEM ASSESSMENT FO-UP Los	Comp	GAIT PRE	GAIT PST	HIPSCORE PRE	HIPSCORE PST	HIPSCORE IMP	FO-UP Mths	Results	Remarks
12.	Sarasu	30	F	630036	CA	R	30-0	-	-	30-0	0	0	LAT	70	20	40	20	15	15	Neu	-	Neu	-	Neu	-	Neu	-	No reduction troch #	ANT	N	12	77	65	25	Fair	Resurgery for reduc-tion done
13.	Bazeer John	46	M	639456	FNF	L	90	0	0	0	0	0	LAT	80	30	40	30	30	45	Neu	-	Neu	-	Neu	-	Neu	-	LLD	ANT	SL	20	97	77	24	Excellent	-
14.	Kalifullah	45	M	648065	AVN	R	90	5	20	20	5	5	LAT	80	20	40	25	30	20	Neu	-	Neu	-	Neu	-	Neu	-	-	ANT	N	13	84	71	23	Good	-
				671819	AVN	L	70	10	20	10	-	10-40	LAT	70	20	45	30	20	30	Neu	-	Neu	-	Neu	-	Neu	-	SUB	ANT	N	13	87	74	18	Good	-
15.	Padma	20	F	644480	CA	R	35-70	-	40	0	0	0	LAT	110	30	60	30	25	50	Neu	-	Neu	-	Neu	-	Neu	-	-	ANT	N	27	92	65	23	Excellent	-
16.	Rajagopal	32	M	647910	CA	L	40-90	-	25-0	-	20-0	-	LAT	80	20	45	30	15	30	Neu	-	Neu	-	Neu	-	Neu	-	-	ANT	N	23	91	68	22	Excellent	
17.	Gomathy	24	F	664944	CA	R	20	5	10	10	10	10	LAT	70	20	40	25	15	35	Neu	-	Neu	-	Neu	-	Neu	+	Sub-sidi-cence	ANT	N	17	84	67	21	Good	
18.	Bhuvaneshwari	21	F	667948	RA	R	20	10	20	20	15	15	LAT	70	20	45	30	25	30	Neu	-	Neu	-	Neu	-	Neu	-	-	ANT	N	18	95	77	20	Excellent	
19.	Ramadoss	47	M	673402	FNF	L	30	0	10	0	0	0	ANT LAT	90	25	50	30	20	30	Neu	-	Neu	-	Neu	-	Neu	-	-	-	N	11	91	80	19	Excellent	
20.	Durga	13	F	670968	TBA	R	40	0	20	15	5	5	LAT	100	20	50	20	15	25	Neu	-	Neu	-	Neu	-	Neu	-	Sup Inf LLD	ANT	SL	15	81	66	19	Good	Done under ATT cover
21.	Perumal	35	M	682061	CA	L	30-90	-	-	20-30	10-15	-	LAT	70	20	45	30	10	20	Neu	-	Neu	-	Neu	-	Neu	-	SNP	ANT	HS	14	89	75	17	Good	Planned for tendon transfer
22.	Kumar	46	M	720284	CA	L	20-60	-	20-0	-	10	10	LAT	90	20	45	25	15	25	Neu	-	Neu	-	Neu	-	Neu	-	-	ANT	N	33	90	57	10	Excellent	
23.	Thangamani	35	F	728478	CA	L	50	20	10	10	10	0	LAT	80	10	30	30	20	30	Neu	-	Neu	-	Neu	-	Neu	-	-	ANT	N	18	65	47	9	Poor	

S.No	Name	Age	Sex	I.P. NO	Diag-nosis	Side	PRE OP ROM						APP	POST OP ROM						ACETABULAR CUP ASSESSMENT				FEMORAL STEM ASSESSMENT				Comp	GAIT		HIPSCORE			FO-UP Mths	Results	Remarks
																				IMM		FO-UP		IMM		FO-UP			PRE	PST	PRE	PST	IMP			
							FL	EX	AB	AD	IR	ER		FL	EX	AB	AD	IR	ER	Pos	Los	Pos	Los	POS	Los	Pos	Los									
24.	Parameshwari	32	F	729930	AVN	L	30	0	-	30-45	0	0	LAT	120	30	50	30	15	45	Neu	-	Neu	-	Neu	-	Neu	-	-	ANT	N	23	96	73	9	Excellent	
25.	Sumathi	35	F	726843	CA	L	40-0	0	0	0	0	0	LAT	75	20	45	25	30	20	Neu	-	Neu	-	Neu	-	Neu	-	-	ANT	N	22	87	65	8	Good	
26.	Gokulakrishnan	30	M	735760	CA	L	60	5	30	10	20	20	ANT LAT	90	20	50	30	20	35	Neu	-	Neu	-	Neu	-	Neu	-	-	ANT	N	38	92	54	7	Excellent	
27.	Podhu	26	F	750984	RA	L	70	0	10	20	15	15	LAT	90	20	50	30	30	40	Neu	-	Neu	-	Neu	-	Neu	-	-	ANT	N	17	85	68	6	Good	
28.	Sargunam	37	F	755470	AVN	R	60-95	-	-	40-50	-	15-25	LAT	80	20	40	20	25	30	Neu	-	Neu	-	Neu	-	Neu	-	-	ANT	N	40	90	50	5	Excellent	
29.	Chenniyappan	66	M	763860	CA	R	10-90	-	-	15-20	5	20	LAT	70	15	40	20	15	25	Neu	-	Neu	-	Neu	-	Neu	-	-	ANT	N	25	78	53	4	Fair	

F - Female, M - Male, CA - Chronic Arthritis, AVN - avascular Necrosis, FNF - Fracture Neck of Femur, AS - Ankylosing Spondylitis, RA - Rheumatoid Arthritis, TBA - Tuberculous Arthritis, R - Right, L - Left, ROM - Range of Movement, FL - Flexion, EX - Extension, AB - Abduction AD - Adduction, IR - Internal Rotation, ER - External Rotation, APP - Approach, LAT - Lateral, ANT LAT - Antero Lateral, POS - Position, LOS - Loosening, IMM - Immediate Post operative, FO-UP - Follow up, COMP - Complications, Neu - Neutral, Ver - Vertical, HOR- Horizontal, MAL - Malposition, Sup. Inf - Superficial Infection, DIS - Dislocation, MIG - Migration, Troch # - Trochanteric fracture, SUB - Subluxation, SNP - Sciatic Nerve palsy, LLD - Limb Length Discrepancy, N - Normal, Pre - Pre Operative, PST - Post Operative, ANT - Antalgic Gait, HS - High Stepping Gait, MTHS - months, IMP - Improvement